Electrical World

February 2, 1946

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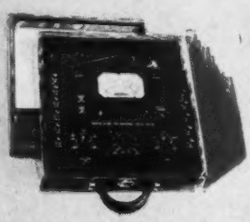

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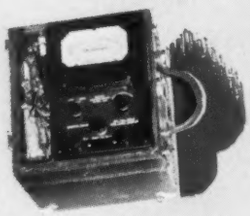

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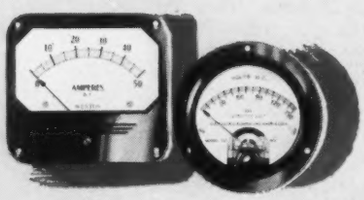

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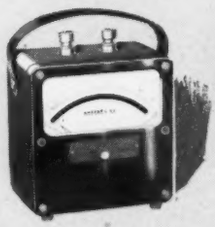

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Here is important news — the return of Okonite insulation — made possible because the use of natural rubber has been authorized for those severe service conditions where wires and cables are to be installed in wet locations.

Back in November, 1943, when the supply of natural rubber was withdrawn, The Okonite Company announced that it would no longer be able to provide Okonite insulation because this high-grade compound could not be made without a particular kind of natural rubber — wild Up-River Fine Para Rubber.

Now, with the gradual return of natural rubber, the latest W.P.B. rubber order recognizes that certain vitally important needs for rubber must be served first. One of these is for wires and cables operating in wet locations, an installation condition where many years of service experience have shown Okonite rubber insulation to be outstanding.

Therefore, Okonite insulation made with wild Up-River Fine Para Rubber, applied to the conductor by the Okonite strip insulating method and vulcanized in a continuous metal mold, is once again available to the electrical industry for these restricted — but most important — applications. *Okonite insulation is exactly the same compound it always was, possessing the same characteristics which years of experience have confirmed . . .* its exceptionally long life, its ability to retain tensile strength and elasticity, its high electrical values. The Okonite Company, Passaic, New Jersey.

A complete story on Okonite insulation is available in Research Bulletin 101 which includes engineering details, illustrations of methods used to safeguard performance, and records of electrical tests.

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THE FAILURE OF "FACT-FINDING"

THE PRESIDENT has asked Congress to grant him authority to appoint fact-finding boards to deal with nationally important labor disputes. Most citizens would like to see some reasonable and objective solution of the industrial strife that now is disrupting reconversion. Unfortunately, the record of the "fact-finding" procedure indicates that any claim of impartiality for this process is a gross misrepresentation.

The Administration bill would authorize the President to appoint such boards in cases certified to him by the Secretary of Labor. Each board would report to the President "its findings of fact and such recommendations concerning the dispute as the board deems appropriate." Its facilities and staff would be provided by the Secretary of Labor. The bill provides for an interval of not more than 30 days known as a waiting or "cooling off" period during which it would be "unlawful" (though no penalties are specified) for anyone to promote or encourage work stoppages.

Because the Administration did not wait for Congressional action upon its proposal, but appointed a number of fact-finding bodies to deal with current emergency cases, we have been afforded at least a partial preview of how the procedure may be expected to work out if laws establishing it are passed.

If the reports handed down by the fact-finding panels in the General Motors and oil disputes may be regarded as representative, it can be stated conclusively that Government-appointed "fact-finding" boards will concern themselves to only a minor degree with the establishing of facts. A far greater share of their effort will be concerned with the speculative business of forecasting future output and production efficiency and appraising the "ability to pay" of the companies involved. But the predominant emphasis will be placed upon framing recommendations for settling the disputes in line with announced Government wage-price policy.

In short, the procedure essentially will be one of registering with the public a government opinion as to how far wages may be raised in the cases at issue without raising price ceilings. Both the General Motors and the Oil Panels stated, in quite explicit terms, that this was their conception of the job assigned them.

"Fact-Finding" in Auto and Oil Disputes

As the General Motors Panel phrased it: "This board subscribes to, and has been guided by, the national wage-price policy" — which it summarizes as calling for wage increases to maintain take-home pay at wartime levels, to the degree possible without inflationary price rises.

The Oil Panel was even more forthright in the statement of what it was supposed to do. "In the judgment of the panel," it declared, "the earnings of the workers must be as high as is consistent with both the maintenance of the stability of the price structure and the provision for reasonable returns to the owners of industry." In other words, prices and the return to investors are to remain fixed, with labor entitled to an ever-increasing return up to the limit of what the traffic will bear.

Having thus outlined their respective conceptions of the job, each panel proceeded to carry out its mission.

The Automobile Panel recommended that General Motors increase its basic hourly wage rates by 19½ cents, which amounts to about a 17½ per cent increase on the company's average hourly wage of $1.12. The Oil Panel recommended an 18 per cent increase in basic hourly wage rates, or an additional 21 cents to the average wage rate of $1.20.

The General Motors recommendation was based almost exclusively upon the Panel's calculation that a 19½ cent raise would keep weekly take-home pay equal to that earned in 1944 when the work-week averaged 45.6 hours. The calculation turned on an estimate of what the effective work-week was likely to be in 1946.

The Oil Panel's recommendation appears to have been based on a more complex but no more conclusive accounting. After calculating that the maintenance of July 1945 take-home pay after 40-hour shifts were restored would require a 22 per cent increase in straight-time hourly wages, it recommended that an 18 per cent increase be made. It accounted for 9½ per cent of this by noting that this was needed to cover cost-of-living rises, and explained that the rest was justified by a combination of factors including loss of premium overtime pay, higher productivity, and settlements already negotiated. Since the Panel gave no indication of the weight given to these several factors, it may not be unfair to assume that the last-named was given preponderant importance, since 18 per cent was the increase already granted in collective bargaining by Sinclair and certain other oil companies.

Higher Pay Without Higher Prices

Both panels stated that the pay increases recommended could be met without raising price ceilings, but neither documents its case on this score with very conclusive "facts".

The Oil Panel confined its observations on this account to the statements that only one company in its group had pleaded "inability to pay" and that the industry was in a generally profitable position during 1943 and 1944.

The Automotive Panel stated that, under a number of assumptions about the 1946 operations of General Motors which it believed to be valid, the Company would have higher earnings than it had in 1941, its previous record year. It specifically stated that its findings in the case were not applicable outside the

automobile industry, but it recognized that the General Motors settlement would more or less determine the settlements of other automotive companies. It stated that it had not been able to arrive at a clear conviction as to the ability of other auto makers to pay similar wage advances, but it dismissed the issue by observing that they could expect to operate at full capacity in 1946, and that this should provide savings to offset the increased wage expenditures.

From the management point of view, one of the most serious limitations in the panels' procedure was their failure to deal with any of the Company claims put forward. In ordinary collective bargaining the demands of both sides are advanced and concessions in one direction are traded for concessions in the other. Here, although the companies involved had insisted upon their need for guarantees against contract violations and wild-cat strikes, and for other union concessions, nothing but the wage issue was considered by the "fact-finding" bodies. The General Motors Panel specifically recommended that the wage increase of 19½ cents be granted, but that otherwise "the status quo prevailing before the strike be restored by the reinstatement of the 1945 contract between the parties." Handled thus, fact-finding becomes indeed a wholly one-sided exercise.

Both panels accepted, quite uncritically, the general position taken by Government spokesmen that wage increases are inflationary only if they are directly translated into price advances. It should be obvious that all wage increases add to the inflationary pressure, if made at a time like the present when consumer purchasing power far outstrips the volume of goods and services available to satisfy it.

"Fact-Finding" Dodged in Steel and Rails

It is ironic, too, that even while the Automotive and Oil Panel groups were holding the "government policy" line, the President and his Reconversion and Stabilization Directors were busily at work trying to dent it. In the steel dispute, although price rises in this industry have a particularly sharp inter-industry impact, hearings by the appointed fact-finding board were deferred while negotiations were carried forward by the President and his advisors under which the industry was offered a price increase of approximately $4.00 a ton on condition that U. S. Steel and the United Steelworkers agree upon a mutually acceptable wage boost. It is hard to avoid the cynical conclusion that wage increases constitute the major administration policy, and that the principle of not translating them into increased prices is sacred only in those cases where there can be some reasonably plausible showing that wages may be raised without price advances.

Much the same general conclusion — that the "facts" are controlling only if they support a substantial wage increase — is sustained by the history of the administration of the Railway Labor Act of 1926, often cited as a glowing example of how "fact-finding" by so-called Emergency Boards of Presidential appointees has served to prevent strikes on the railroads. It is true that reports of almost all of the 31 Emergency Boards appointed to look into threatened railway strikes in the 20 years since the act was passed have provided the basis for a settlement of the disputes in question. The fact — a real fact — remains, that in 1941 and again two years later the wage adjustments found appropriate by Emergency Boards in major railway labor disputes were revised upwards at the White House after the unions involved rejected them as unsatisfactory and threatened to strike. The second upward revision was made after government seizure of the railroads to prevent a national transportation tie-up. When the "facts" did not indicate a large enough wage increase to satisfy the union and the Administration, the "facts" went out the window.

It would be irresponsible to deny the importance of finding some tenable solution of current disputes that threaten to completely disrupt the reconversion process. But upon the evidence of experience, "fact-finding" boards cannot be expected to operate according to the common conception of their function — as agencies designed to sift out for the public an objective and significant weighing of the facts behind conflicting claims.

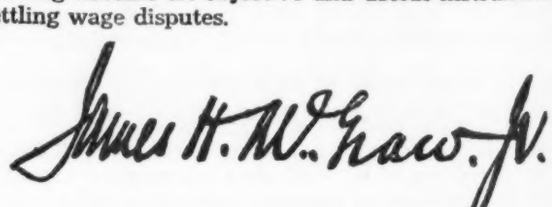
Without Principles Facts Mean Little

Facts, if they are assembled upon a sufficiently partisan basis, can be made to document almost any case one wishes to establish. The major difficulty in marshalling facts to resolve wage disputes is that there are no agreed-upon principles to determine the levels at which wages should be set. In the absence of such principles, it is inevitable that "fact-finding" boards, appointed by the Administration, manned largely by those who helped develop and administer Administration wage policies, and depending for technical assistance upon Administration Departments, will serve merely to implement Administration wage policy.

If Government means to reassert its wartime authority to fix wages — an objective specifically disavowed by the President and seemingly wanted by no one — it should accept the responsibility directly, rather than operate to that end through "fact-finding" boards which are independent in theory, but which cannot be so in fact.

The failure of the brand of "fact-finding" now urged upon Congress by the President is evident. Therefore, we must look for a solution along other lines.

What is needed is for labor and management to agree upon the principles that should govern the determination of wages under free collective bargaining. When such agreement is reached, then and only then, can fact-finding become an objective and useful instrument for settling wage disputes.



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Electrical World

FEBRUARY 2, 1946

Markets Are the Answer

AT LAST the President has shown without equivocation where he stands on public power—he is for it in a big way. In his budget message to Congress he made it clear that he not only favors government construction of federal hydro projects but steam generating plants as well to firm them up and transmission lines to bring the energy to a market.

To back up the President the Department of the Interior has prepared its policy for promoting such projects documented with records of Congressional sanction. And, as if to place the stamp of approval on certain trends that are developing, the Federal Power Commission policy on river development has just recently been stated.

While every action was made separately, there is nevertheless a pattern and a timing which can leave no doubt that the present Administration, if not a stronger, is as strong an advocate of public power as any which preceded it.

Today the stakes, if anything, are higher than before. The first complete record of all projects including those in operation, in construction, under study, and ultimate, was presented in our January 19 issue, state by state. Through the end of last year, some 21 states had federal or state power projects totaling 5,600,000 kw. In addition projects aggregating over a million kilowatts are under construction in 8 states and nearly 6 million more is authorized or approved for 24 states. Nor is that all, for some 7,500,000 kw. are under study in 12 states. These add up to approximately 20 million kilowatts to which must be added another 8 million to complete present estimates of ultimate capacity—28,000,000 kw.

How is this mounting threat to be met by the private utility industry? There are several possibilities. The easiest way, of course, and one which has met with favor in some instances, is to wait for public bodies to offer an attractive price and then sell out. The hard way, but the one most likely to show favorable results over the long pull, is to sell electric service as it has never been sold before.

Markets are the answer. Markets that don't exist but must be created. Markets that must be conceived in fertile imaginations and born in initiative, confidence and hard work.

Cooperatives and municipalities should not be relied on to provide these markets. That is the job the private industry wants to assume and should assume.

In the past, private industry has made the mistake in certain instances of refraining from expanding its generating capacity because so much new government capacity was coming in. Although private industry is willing and ready to market publicly generated power, it should never be placed in the position where it is dependent upon government power. Therefore, marketing plans must include not only the disposal of the purchased energy but of an ever-increasing supply of its own.

Part of this battle on public power will of necessity have to be fought in Washington, but the long-term struggle will be one of markets. Politics may dictate the battle line in Congress, but the battle line in markets can with the right kind of vision be determined by those who have the know-how—the private utilities.

Northwest Power Pool Reservoir Operation—I

Philosophy and rules governing intricate operation of 21 storage reservoirs in four million kilowatt power pool are detailed—Allowances made for exigencies and emergencies

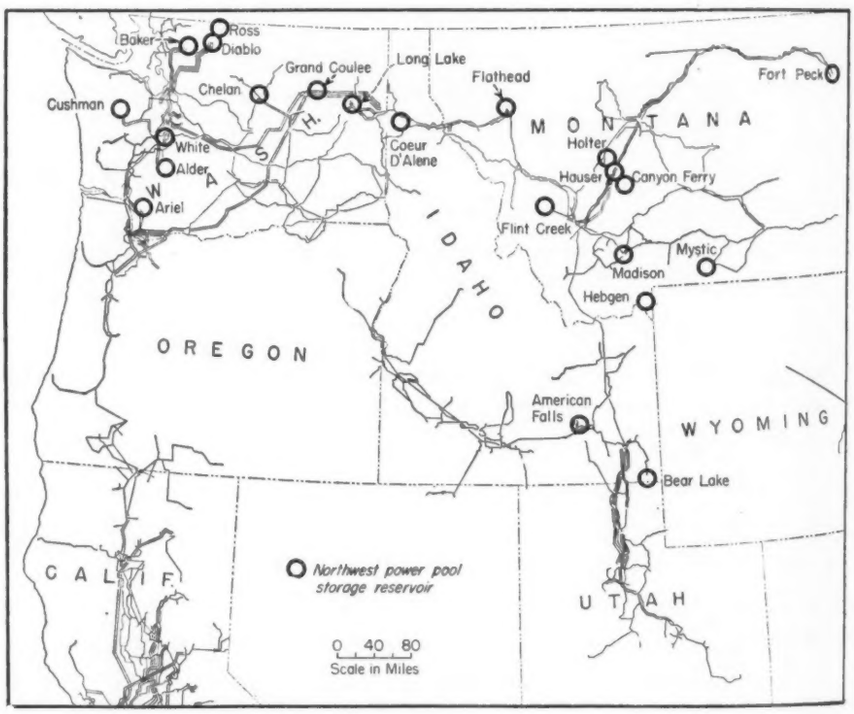
E. N. PETERSON, Ebasco Services Inc.

ALLOCATING storage draft among 21 reservoirs, scattered over a quarter of a million square miles and owned by nine of the eleven utilities comprising the Northwest Power Pool,* is a complicated problem. Not only must this be done in accordance with the established basic principles governing pool operation, but it must satisfy load requirements, physical limitations and special operating conditions. It must also satisfy the reservoir owner. This requires an intimate familiarity with the territory and conditions therein.

From the ensuing discussion it will become apparent that the storage reservoirs in the area, representing only 11 percent of the firm annual energy resources, play a role the importance of which is out of all proportion to their aggregate size. Equally apparent will be the fact that great and tangible benefits to pooled operation accrue from the treatment of reservoirs as a pool resource rather than an individual resource.

To realize fully these benefits and carry the load under critical water conditions, the most careful analysis, scheduling and operation of reservoirs are justified.

The Northwest Power Pool has 21 storage reservoirs located in widely separated drainage basins on both sides of the Continental Divide, as shown by the accompanying map. Regardless of ownership, these reservoirs are operated for the over-all benefit of the eleven interconnected systems. This article records the methods developed and experiences gained over a period of years in operating these reservoirs for the common good.



MAJOR storage reservoirs, Northwest Power Pool

Northwest Power Pool

The Pool includes virtually all utilities in Idaho, Utah, Montana, Washington and northern Oregon. A breakdown of ownership of the 294 interconnected generating plants shows that three plants are federally owned, with a capacity of 1,375,000 kw.; 11 are municipal with 477,000 kw.; 115 are privately owned with 1,681,000 kw., and the remaining 165 plants with 515,000 kw. consist of miscellaneous small utilities, industrials, etc. Total name-plate rating of all connected generators is 4,048,000 kw., of which 3,308,000 kw. is owned by Pool members. Hydro capacity amounts to 3,267,000 kw., or 81 percent of the total. This leaves 781,000 kw. of steam capacity, of which 403,000 kw. belongs to member systems.

Operation of the Pool is by means of an operating committee consisting of one or more members from each of the eleven major participants. This committee is assisted by a small group of consultants who constitute the coordinating group. Weekly telephone con-

* For description of the pool and its operation see "Northwest Power Resources Pooled for War," ELECTRICAL WORLD, March 4, 1944, page 59 (845).

ferences and reports, periodic meetings and trips over the territory by these consultants aid greatly in pool operation. Under the general guidance of the operating committee, the coordinating group prepares operating programs, schedules system tests, advises on calculating board studies and other technical matters, and generally acts as a clearing house of information.

As compared with the figures given on rated capacities, it is interesting to note to what extent the energy load is carried by the various available resources. In the twelve months beginning July 1, 1945, scheduled distribution of energy load under critical water conditions is: Generation from natural stream flow, 83 percent; from storage, 12 percent; from steam, 2 percent, and miscellaneous purchases, 3 percent. Needless to say, better than critical water is to be expected, in which case the first item will increase and the last two will virtually vanish. The reservoir storage, small as it is, is not all controllable. This indicates the narrow margin of operating flexibility and the need for extreme care in scheduling the storage that is controllable. This is particularly true since, at the most critical period in the dry season, as much as 40 percent of the entire pool load is carried by storage.

Reservoirs

Storage reservoirs of the eleven pool members have a total capacity of 2,776 kmwh. (millions of kw.-hr.) This does not include Bear Lake in Utah which contains an additional half billion kw.-hr. The total is not a precise figure as the energy value of a reservoir depends upon many factors. It is difficult enough to fix the top elevation because of irrigation requirements, license restrictions, need for a "hole" to catch floods, etc., but the bottom of the lake is still more nebulous due to emergency reserve requirements and to physical, political and mental restrictions. Once the volume of water in a reservoir is computed there comes its conversion into potential kw.-hr. This too, depends upon many variables, such as whether one assumes a wet year with its attendant waste or a dry year, whether plants are operated at peak capacity or peak efficiency, variable head, etc. With the foregoing reservations, the breakdown of the 2.8 billion kw.-hr. of storage in the Pool is given in the accompanying table.

Of the total gross storage listed, the 1945-47 operating program calls for use amounting to 2,525 kmwh., or 91 percent of available. The difference represents largely reserve usable only in extreme emergency. This program is based on critical low water conditions for the entire Northwest, and under such conditions most of the reservoirs are virtually empty when the rains come. This is as it should be.

Strategic value of storage is well illustrated in the accompanying graph of average loads and resources, which shows, among other things, estimated average load and firm resources of the pool. It is seen that the area, i.e., the energy, represented by draft on storage is small compared to the total area. Nevertheless, in January, 1946 and 1947, the vertical ordinate of the storage, i.e., the total kilowatts of load carried by storage, represents 40 percent of the total load.

There is controllable storage and non-controllable storage and all gradations of controllabilty in between. A controllable reservoir might be loosely defined as one in which the storage can be accumulated in the wet season and held for use when, as and to the extent needed during the dry season. In addition, there must be sufficient downstream generating capacity to utilize the variable flow with small wastage. The Cushman reservoir of Tacoma City Light, the enlarged Ross reservoir of Seattle City Light, the Hebgen reservoir of the Montana Power Company are typical, controllable reservoirs. Non-controllable reservoirs may be so for various reasons. Drafting at a uniform rate may be required because of limited machine capacity or danger of damage to property owners from surges in the river or from avoidable floods. Ownership of the stored water, or part of it, by irrigation interests may limit controllability for power purposes.

Breakdown of 2.8 billion kw.-hr. storage in Northwest Power Pool

NAME AND STATE	UTILITY	KMWH.
American Falls, Idaho	Idaho Power Co.*	12*
Flathead Lake, Mont.	Montana Power Co	250
Hebgen Reservoir, Mont	Montana Power Co	175
Other Storage in Mont. (6 reservoirs)	Montana Power Co	120
Coeur d'Alene, Idaho	Washington Water Power Co	91
Long Lake, Wash.	Washington Water Power Co	17
Chelan Lake, Wash.	Washington Water Power Co	210
Grand Coulee, Wash.	Bonneville Power Adm. (U. S. B. R.)	1210
Baker (Lake Shannon), Wash.	Puget Sound Power & Light Co	24
White (Lake Tapps), Wash.	Puget Sound Power & Light Co	18
Ross (incl. new constr.), Wash.	Seattle City Light	359
Diablo, Wash.	Seattle City Light	20
Cushman, Wash.	Tacoma City Light	151
Alder, Wash.	Tacoma City Light	82
Ariel, Wash.	Pacific Power & Light Co	27
TOTAL STORAGE IN MILLIONS OF KW.-HR.		2766

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Basic Principles

To guide the coordinating group in working out the various programs, schedules and reservoir rule curves in a manner acceptable to the pool members, the operating committee established and agreed upon a set of basic principles. In their present form these principles or fundamental rules have been "through the wringer" many times as more and more experience was gained. Before discussing these it may be well to define a few terms used that are not self-explanatory. Among them are: reservoir rule curves, critical water, and freeze-ups.

A *rule curve* is merely a time schedule of reservoir draft. For each storage reservoir a rule curve is established which shows the elevation of the reservoir at any time during the drawdown and subsequent filling periods.

Critical water is the lowest water condition that is expected to occur simultaneously over the entire pool area. It is based on historical flows and is determined by calculating each system's hydro resources for a number of low water years, and picking out the year of over-all minimum resources for the pool as a whole. For the Northwest Power Pool the year beginning July 1, 1936, is the critical water year.

Freeze-ups is a word not found in the dictionary, but well known to the Northwest. Freeze-ups represent reduced output due to prolonged subfreezing weather. This results in "negative" river flows, meaning that downstream flows are less than flows further upstream, disruption of the sched-

uling of storage water and reduced system output.

The "Operation of Reservoirs" and the rules therefor as set up by the operating committee are given below. The rules have been rephrased for purposes of clarity and brevity.

1. *Preparation of rule curve.* Prepare a rule curve for each reservoir showing reservoir draft versus time, based on critical water and estimated loads and providing for complete utilization of all available storage.

The rule curves, prepared by the coordinating group in cooperation with the reservoir owner, are drawn up for the individual reservoirs only after the monthly utilization of over-all storage requirements for the entire pool have been determined. These vary with the load and assumed natural stream flow resources but the total storage draft for all the reservoirs of the pool during the dry months cannot exceed, and in fact should just equal, the total storage available.

Once the over-all scheduling of storage draft has been done, it is necessary to allocate the draft among individual reservoirs in such a manner that the total will follow the pool schedule. Other things being equal, this would be accomplished on a simple pro rata basis. But, unfortunately for the hapless allocator, other things are decidedly not equal. Some of the limiting factors affecting the allocation of storage draft among the individual reservoirs will be discussed later. The second "rule" is:

2. *Rule curve gives minimum elevation.* Reservoirs are not to be drawn below the rule curve except:

(a) When failure to do so would necessitate dropping load.

(b) When unforeseen emergency conditions require it temporarily.

(c) When the approaching end of the drawdown season prompts a revision in the operating regime.

(d) Where there is assurance of adequate generating and transmission facilities for bringing reservoir back to the rule curve in a reasonable length of time.

This principle or rule really means that the rule curve is to be considered as the minimum elevation to which a reservoir should be drawn. This is the result of another principle, not directly related to reservoir operation, to the effect that, regardless of what has occurred up to any given point in the drawdown season, critical water may occur from then on. Since the rule curve calls for an empty reservoir at the end of the dry season of a critical water year, it is evident that, if the reservoir is drawn below the rule curve, it may become empty before the dry season ends. That's bad.

But there are mitigating circumstances. Some are indicated in exceptions a, b, c and d under Rule 2. No one quarrels with exceptions a and b. The load must be carried and that's that. The same holds for exception c provided the change in operating regime is handled as a pool matter and is not unilateral and unknown to the other systems. Under exception c the operation would be somewhat as follows:

Operator A may find that, so far as his own system load is concerned, he can safely carry his load under critical conditions even if he does go below his rule curve. Naturally it is to his advantage to use or to sell the energy represented by this additional drawdown and he broadcasts his intention of doing so. Assuming that all other reservoirs are on the rule curve, one or more other systems would then find it profitable to buy from A the energy represented by the proposed additional draft. In such a case this stored energy would merely change ownership and the reservoir water level would remain on the rule curve.

Weather Conditions

Exception d permits the system operator, while keeping an eye on the rule curve, to take a look at the weather occasionally. If it is raining generously and ground water levels are high, it is a little artificial, not to say foolish, to assume critical dry conditions beginning tomorrow. Hence, in the last analysis the rules and the rule curves are for guidance and not for tyrannical dogma.

But there is danger in too much latitude. Logically, reservoirs should be drawn upon when the weather is dry and replenished when the weather is wet. But here human nature seems to function in reverse. When rainfall is non-existent the operator is inclined to fear that it never will rain, so he buys energy, sometimes even steam energy, rather than draw upon his own reservoirs. Contrariwise, when a heavy shower comes, the operator is apt to assume hopefully that this is it and that his troubles are over. Accordingly he reduces his purchases and orders all hydro plants wide open! Comes now Rule 3.

3. *Rate of reservoir draft.* Each reservoir shall be drafted to follow the rule curve except:

(a) When excessive natural flow, freeze-ups or other physical obstacles prevent such drafting.

(b) Where drafting at a reduced rate will not increase steam generation.

(c) Where drafting at less than the rate called for on one reservoir results in drafts greater than that called for on another reservoir.

(d) When there is storable surplus hydro in the pool not usable for steam replacement.

(e) Where present storage of low cost energy reduces need for high cost steam generation at a later date.

Whereas Rule 2 warned against going *below* the rule curve, Rule 3 calls for staying on the curve, i.e., not going *above* it. This is a good rule but difficult to follow. One reason for this, as indicated in exception d, is that the water supply is generally much better than critical. This is of course a happy condition but results in greatly reduced interchange and correspondingly increased non-usable, non-storable surplus hydro. Naturally the possessor of such unsalable surplus has no particular cause for rejoicing.

The list of exceptions to this Rule 3 has grown with time and experience. Most of them are self-explanatory. Many of them overlap considerably. Exception c, which refers to compensating movements of reservoirs, has occasionally been applied in a somewhat broader sense. So long as there is sufficient peaking capacity in the pool (which there always is), and sufficient transmission capacity (which sometimes there is not), drafting a reservoir below its rule curve is not cause for alarm if the total usable energy in storage has not fallen below the aggregate rule curve for the entire pool.

Exception e is a matter of probabilities. The system operator must decide whether to buy cheap surplus now and store it or run the risk of having to buy more costly energy later. Suppose the early purchase costs $100,000 and the late $400,000. The chances are say 1 in 5 that later months will be dry, in which case he will need that additional energy. On the other hand,

if he does not buy the energy now, the chances are 4 out of 5 that he need not buy it at all. But the odd chance of 1 in 5 may come up and then he is stuck for the larger amount. So on the early purchase he pays $100,000 a year, whereas on the late purchase he pays $400,000 once in five years or $80,000 a year average. In such a case procrastination pays.

Energy Loans

Closely related with this matter of probabilities is the practice of lending energy out of a reservoir. Such energy is delivered to another utility but has a string tied to it so it can be reclaimed when and if needed later. Rule 4 sets up the routine for this.

4. *Lending stored energy.* A utility having a reservoir above the rule curve may wish to conserve this added energy as insurance against the risk of having to purchase high cost energy later. It can do so and still draft the reservoir down to the rule curve by lending such energy to another utility.

(a) A condition of such a loan is that the receiver will return the energy upon request regardless of its cost.

(b) Other terms and conditions are to be agreed upon at the time of making the loan.

This rule permits a reservoir owner to establish a guaranteed credit with another pool member, a credit which he can cash in on at any time in accordance with the agreement. This is merely another incentive for staying on the rule curve.

From the pool standpoint the loan transaction permits the utilization of a badly needed hydro resource now, and a corresponding saving in fuel, without the resource being lost to the original owner. In addition, it removes the possibility, or rather the probability, that this stored energy will be wasted later in the season.

The first attempts at lending stored energy resulted in numerous difficulties due to misunderstandings as to what had been agreed upon, and unfamiliarity with the many factors to be considered in setting up such an agreement. These causes for surging blood pressures have been gradually removed by preparing a "tickler list" containing all the known and foreseeable items to be discussed and agreed upon in any proposed lend-lease transaction. This tickler list is given later.

The next rule is closely tied in with Rule 3 c, which permits staying above the rule curve by purchasing present cheap surplus energy in preference to later purchasing high cost energy. Rule 5 places a limit on this operation.

5. *Limiting outside purchases.* A utility, desiring to conserve energy in storage by purchasing outside energy (in order to avoid the risk of incurring the generation of higher cost energy at a later date), shall limit its purchases to the amount it can physically take into its system at the time.

This involved rule is intended to insure general and widespread distribution of available surplus without unnecessary waste and prevents one utility from assuming the role of broker in the purchase and resale of pool surplus to other utilities.

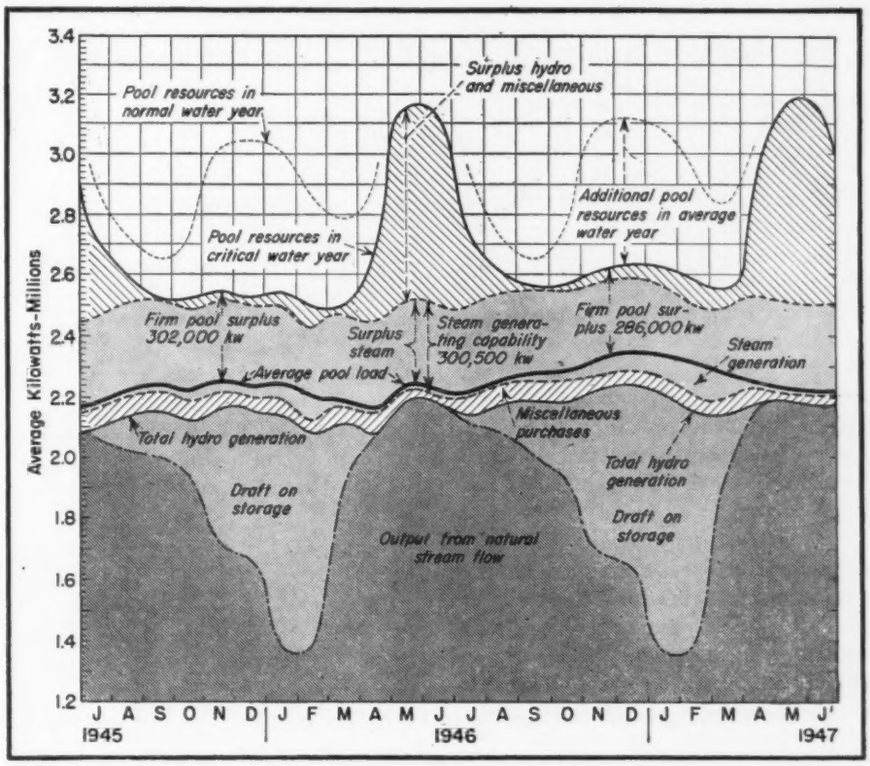
6. *Limiting steam generation.* Steam plants should not be started while reservoirs are above rule curves without consulting other utilities to determine if such steam generation could be avoided, except:

(a) In case of an operating emergency requiring such additional generation to avoid dropping load.

(b) Where the steam generators are required for power factor correction.

(c) Where unforeseen transmission limitations develop that make such operation necessary.

The evident purpose of this rule is to conserve fuel, which is the second prime objective of the power pool, the first being that the load must be carried. It implies that each utility has full knowledge of the general situation with regard to reservoir elevations versus rule curves. Such information is in fact distributed weekly through the coordinating group by charts, tables and brief reviews of current operations.



AVERAGE LOADS and resources under critical water conditions on Northwest Power Pool for the period from July, 1945, to June, 1947

7. *Refilling reservoirs.* Rule curves shall provide for refilling the reservoirs by July 1 on the basis of the lowest recorded runoff during the filling period. After the drawdown period, reservoirs shall be refilled in accordance with this rule curve except:

(a) When minimum generation fails to bring the reservoir up to the rule curve.

(b) Where water conditions can be predicted to be assured of filling later.

(c) When steam generation is necessary to provide the energy to fill the reservoir.

This rule and other important aspects of reservoir operation will be discussed in a subsequent article.

Three-Mile Feeder Combines Four Types of Construction

Open-wire, aerial cable, submarine and underground construction are combined to render 13.8-kv. war-plant feeder circuit unobtrusive in residential area—Vertical, crossarmless open-wire configuration gives horizontal clearance on buildings in business areas

R. M. BERT, R. D. LORENZ† and J. J. GRAVEN‡, Central Illinois Electric & Gas Co., Rockford*

ROUTE of the new 13.8-kv. line of Central Illinois Electric & Gas Co., which serves an ordnance plant on the northern outskirts of Rockford, departs only 5 percent from a straight line in its entire three-mile length from source to load. Yet in that short distance four fundamentally different types of transmission construction have been employed; overhead open-wire construction, aerial cable, submarine, and underground parkway cable.

Because this line traverses the heart of the Rockford residential area, where conventional overhead construction would be inharmonious with the surroundings, the company has used every design means available to make this war-plant feeder as inconspicuous and unobtrusive as possible.

Use Vertical Configuration

Even the two open-wire sections of the line, threading a warehouse and business district with some intermingled residential area, were unconventional. Recourse was had to a "crossarmless" construction with the three 4/0 stranded conductors supported in a vertical configuration by 25-kv. line-post insulators on the top and side of poles. Since the ordnance plant load requirements were indefinite, pole heights were selected to provide room for double-circuit crossarm construction. This automatically provided space for the present vertical configuration with its attendant construction simplification and saving of materials. The vertical configuration makes a "cleaner" appearing line and provides better building and tree clearances.

Route of the open-wire section was along that of an existing 4-kv. line. It was found that the new line could be built into this low-voltage circuit by replacing alternate poles and rearranging the 4-kv. line on each new pole. Alternate existing poles were replaced with 60-, 65-, and 70-ft. class 1 and 2 full length toxitized-treated, Pentrex butt-treated western red cedars.

Conductors were strung for a maximum loaded tension of 2,000 lb. with a 200-ft. ruling span. Vertical spacing between the top (ridge) and middle conductor was 5 ft. 9 in.; between the middle and bottom conductors 5 ft. 6 in. As previously noted the conductors were carried on line-post insulators bolted directly to the pole or, in the case of the top conductor, to a ridge iron.

Where double insulator support was

JUNCTION POLES are the exception to the rule of no crossarms on the open-wire section of the Barnes line. Note underbuilt 4-kv. line

* — Distribution Superintendent
† — Senior Electrical Engineer
‡ — Distribution Engineer

AERIAL TO UNDERGROUND armored parkway cable transition is by direct splicing. Aerial cable is supported on rings from ½-in., 18,800-lb. steel messenger strand

AERIAL CABLE in neighborhood shopping area was installed on existing steel poles that supported the 4-kv. distribution lines and trolley bus system

required at telephone crossings and similar locations, two line-post insulators were bolted 12 in. apart on the base of an 18 by 18 in. triangular steel plate bolted to the pole base-up.

Aerial Cable Used

The aerial cable section, about 3,000 ft. in length, passed through a residential and business area that is heavily congested with tall trees, a fact that accounts in part for the use of aerial cable in preference to open-wire construction.

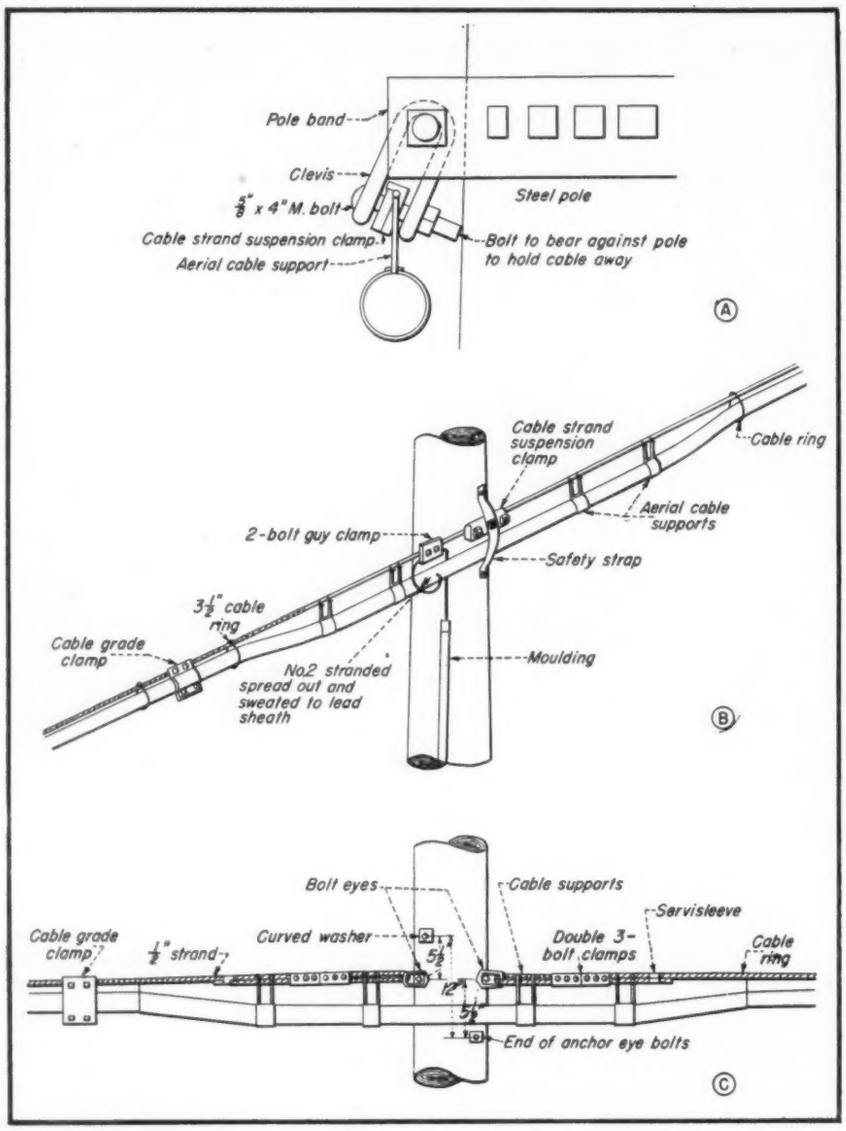
To support the cable, which weighs 10.3 lb. per ft., a new and heavier pole line was installed to replace the lighter one that supported existing 4-kv. roadside distribution circuits and the trolley bus system. The new 40- and 50-ft. class 3 poles were spaced 90 to 100 ft. apart.

Messenger used was ½-in. 18,800-lb. high-strength steel strand from which the cable was suspended in rings spaced at 15-in. intervals. The messenger was strung at a tension of 7,400 lb. for a ruling span of 120 ft. and allowed to stand for two weeks before the 350,000 cir. mil shielded three-conductor, compact sector, type H, lead-sheath, aerial cable was pulled in. This tension was selected to give a maximum loaded tension on the messenger of less than 60 percent of ultimate, or about 11,200 lb. Under heavy loading conditions the maximum load, in the plane of the resultant, imposed on the messenger by the cable is 13.9 lb. per ft.

SUBMARINE CABLE carries circuit under Rock River at point where park and lawns extend to river bank on the far shore. Shore sections buried 3 ft.

Different schemes are used to support the messenger strand on wood and steel poles. Cable and messenger attachment to wood poles were made by two ⅝-in. machine bolts, safety strap and three bolt suspension clamp 25 ft. above ground. Space between the cable and pole, sufficient to prevent chafing, is provided by two extra nuts on the through bolt between suspension clamp and pole. At steel poles, the messenger is attached to a pole band by a clevis having ⅝- by 4-in. machine bolt threaded through the center hole of a three-bolt messenger suspension clamp. This bolt is long enough to bear against the steel pole so as to hold the cable away from the pole face. This scheme for mounting the cable on steel poles has proved so satisfactory that it will probably be used in the future for supporting cable from wood poles in preference to the through-bolt scheme.

One end of the aerial cable is spliced directly to the underground cable riser at the first aerial-cable pole. At the opposite end, however, it terminates in a pothead from which leads are trained up, at the outer ends of 8-ft. crossarms,



AERIAL CABLE SUPPORTS of different types were used on (A) steel poles and (B) wood poles. At light angles cable was arranged as in (C)

OPEN-WIRE, POLE-TOP arrangements show details of vertical construction at (A) tangent structures, (B) telephone crossings and (C) cable junction poles

to connect with the dead-ended vertical conductors of the overhead open-wire line section.

Submarine Cable Section

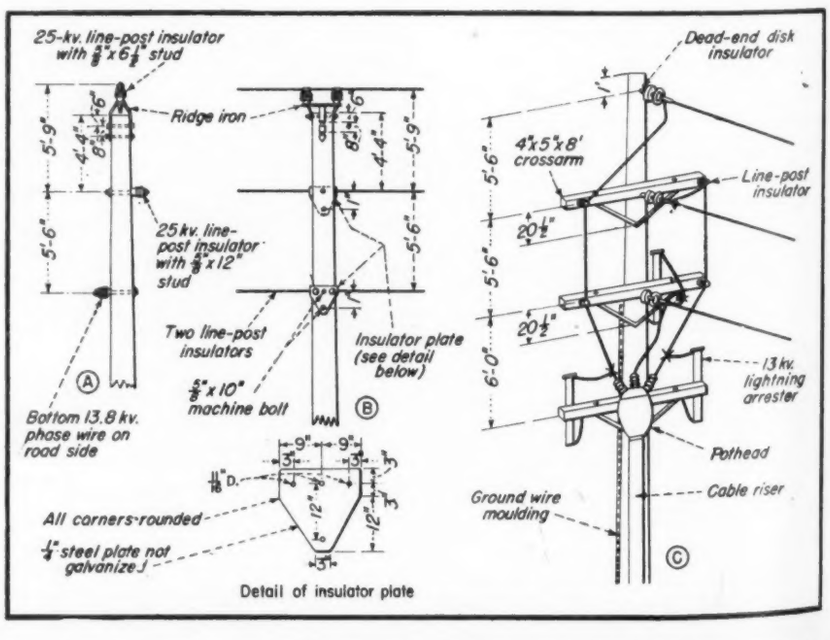
Where the feeder route crosses the Rock River, wide lawns sweeping down to the river bank and rights-of-way across private property made it virtually mandatory to use submarine cable in the interests of appearance. The submarine cable used is 350,000 cir. mil. compact sector, Type H, shielded, lead covered with No. 4 B.W.G. steel wire armour for 15-kv. ungrounded neutral service. Shore sections of the cable are buried at a depth of 3 ft.

Connection between the submarine cable and the aerial cable is a short section of underground cable consisting of 715 ft. of 350,000 cir. mil, three-conductor, type H, armored parkway cable buried directly in earth at a depth of 30 in. Cable in the trench is covered with creosoted pine 2- x 4-in. timbers as "pick" protection. The underground cable is spliced directly to the aerial cable at one end and to the submarine cable at the other.

Line Terminal

The line, which has an estimated capacity of 7,500 kva., taps a double circuit 13.8-kv. tie line extending between the Rockford generating station and 132/13.8-kv. Charles substation in the east part of the city where the Rockford system is interconnected with another utility. Thus the new circuit has the advantage of two sources of supply, each provided with suitable fault interrupting facilities.

Sectionalizing switching for the feeder consists of a 15-kv. 400-amp. three-pole outdoor type load disconnect switch at the supply terminal of the line. The switch is capable of interrupting load currents up to 400 amp. at moderately low power factors and is provided with a motor-operated mechanism arranged for remote control from the generating station 1,100 ft. distant.



Power Supply Aspects of Nuclear Research*

Transmission facilities simplified—Reliable service a primary function—Huge electromagnets and close controls required special designs still held military secrets—New era opens in atomic power development

R. R. WISNER†, Asst. Chief Elec. Engr., Stone & Webster Engineering Corp., Boston, Mass.

PUBLICITY ABOUT THE ATOMIC energy program given in the Smyth report to the mass spectrograph, the cyclotron, and the Van Degraff atom smasher should convey to many of you engineers that electric power supply, electromagnets and electronics play important parts in the process of separating the isotopes of uranium on a commercial scale by electro-magnetic means.

It is now no secret that we built some very large magnets. Motor-generator sets are used for excitation and each one has a definite duty of giving 100 percent service continuity on 100 percent annual load-factor basis, no standby on reserves provided.

For the cyclotron and the mass spectrograph, steadiness of the magnetic field is of the utmost importance. A regulating device for the m.g. sets and magnets was developed that held the magnet excitation to a variation of less than one part in 5,000.

Magnets a Problem

Usually the matter of insulating for operation at 300 to 1,000 volts d.c. to ground would present no serious problem to the electrical engineer. You would probably believe that a good air-dried fibrous insulating board soaked in oil would suffice; but in this case it was not so simple, because there are about 40 tons of such insulation between the conductors and ground in one magnet. Two simultaneous grounds on the electric circuit of one of these magnets would be a catastrophe.

Moisture, magnetic particles and rust were our worst enemies. Considerable heat is generated in these giant electromagnet coils, and transformer oil was used as the cooling medium, through heat exchangers. All fibrous insulation had to be thoroughly dried, the oil piping system had to be made and maintained scrupulously clean and dry, and the installation had to be made with the greatest care. The dielectric strength of this oil is kept at a value higher than in the 154-kv. transformers supplying the project.

Aid from Physicists

The d.c. field of a generator or large d.c. solenoid has quite a kick when the current is interrupted. In this case we really had a problem in handling the switching and the open and short-circuit protections of the magnet and its coils. Among other things we installed ingenious protective devices across the individual coils. The physicists did a remarkable job in working out the characteristics of the magnets, since the actual results obtained were above expectations.

A Radio "Ham's" Paradise

With the cyclotron and mass spectrograph are associated sources of high voltage direct current supply that must meet exacting requirements in adjustment and constancy of potential, viz., one part in 2,500 to 5,000. To provide the required power supply and its controls, many thousands of standard items, particularly electronic, were used in very ingenious circuit arrangements.

As in a radio station, cooling with water having a very high resistance value is required to give adequate insulation to ground on some of the high voltage circuits. For this project there was developed a high resistance water cooling system using continuously deaerated deionized water which allowed the use of common materials for the water piping circuits. Many hundreds of thousands of feet of special cable were designed and placed in successful operation. The power sources to high voltage supply units and accessories, such as Kinney and diffusion pumps, are taken from unit substations by radial feeders and mains.

Future Atomic Power Outlook

With respect to the future possibilities of the electromagnetic process in the development of atomic power, it appears to me to have almost unlimited scope. I believe that method to be most versatile in the commercial separation of any of the many isotopes. It should be possible to work out an atomic energy combination that, while not so efficient and violent an explosive as U-235 or plutonium, could be more practical, plentiful and economical for power generation purposes, for example, as gasoline is to TNT. By the accomplishment of obtaining and successfully controlling relatively large quantities of atomic energy, I believe there has been created a new field for scientific and commercial development of power generation and utilization. Edison spent years searching for a practical and cheap means of converting fuel directly into electrical energy. It may be that we are now nearing something even better than the answer to that problem.

* From a paper before the Boston section A.I.E.E., November 20, 1945.
†Asst. Project Engr., Atomic Bomb Development in Tennessee area.

Power Company Takes Lead in Area Industrial Development

Puget Sound Power & Light organizes and implements program to attract industries to central and western Washington and to reinspire local enterprise—Group action plan organizes each community

C. T. BAKEMAN, Puget Sound Power & Light Co., Seattle, Washington*

GROUP ACTION is the key-note of a comprehensive industrial development program being carried out by the Puget Sound Power & Light Co. in a plan of partnership with the communities it serves covering western and central Washington—the industrial heart of the State.

The Chamber of Commerce of the City of Bellingham (population 33,000) was the first community organization to take advantage of this program, and this group action has now materialized in the industrial brochure "Profit for Your Industry," portions of which are illustrated in this article. The whole program dates back over a year ago when a few of the business leaders of Bellingham began to ask themselves what that city was going to do about the reconversion of greatly expanded war industries and about the continuing industrial growth of the city. They called in the power company for assistance and out of these discussions grew a group action plan which now is available to the entire territory served by Puget Power.

The group action plan first organized the industrial and civic leadership of the community into a group of action committees to prepare a thorough inventory of the industrial advantages and factors of the area. All segments of the community were included, industry, commerce, labor, agriculture, local government, etc., cementing these elements together in an action program with an objective (payrolls and prosperity) of direct benefit to each. Committees were set up on markets, raw materials, basic industries, agricultural resources, human resources and living conditions, power, water, and other facilities, local government, industrial sites, etc.

The facts developed by these committees were then turned over to the power company industrial specialists for supplemental information and for careful checking. Other authorities were called in to check on the facts and for advice. These facts were then boiled down and pointed up to the most important factors that would be conducive to the expansion of existing industries and would attract new industries to the area. The power company made available the services of its advertising agency for arrangement, layout and illustrations of these facts in an effective printed salesman of the Bellingham and Whatcom County area, resulting in the brochure "Profit for Your Industry."

The entire project was under the supervision of a top steering committee

* Director of Industrial Development.

RESULTS

THE EDITOR'S REACTION to this article, when it was received from the author, was, "Very nice program, indeed. But is it just another one of those nice programs, like Huck Finn's trial of prayer?" Remember how Huck reported that "Nothin' come of it"? The question was put to Mr. Bakeman and he came back with the following:

"The project was aimed equally at the stimulation and development of local enterprise and expansion as well as at the attraction of industries from outside the area. The latter is a long-range program which we could not expect to accomplish over night, and the development of the prospectus, "Profit For Your Industry," is only the first step or stage of this long-range program. The first result we are looking for here is the development of prospects, and in this respect initial results have been more than gratifying. Almost immediately letters of acknowledgement began pouring in to the Bellingham Chamber of Commerce and some were directed to our company. These are letters from all types of firms and organizations, both local, Pacific Northwest, and from points throughout the United States, including industrial firms of various classifications, industrial engineers, letters from the trade and technical publications, from other chambers of commerce and from public officials. One of the most substantial forms of interest was expressed by the major consulting engineering firms which have a strong influence in the location and construction of new plants by their clients. These responses may be considered a prime prospect list, and it is a part of this over-all program to "follow-up" these prospects and these sources of additional prospects that are still coming in.

"The most immediate and tangible result of the project has been a unifying of all elements of the community and the stimulation of local enterprise and capital to the profitable expansion opportunities ready at hand. Quoting Gerry Gannon, secretary of the Bellingham Chamber of Commerce: 'The survey has made our people conscious of the splendid opportunities in this area. It has united the rural district of Whatcom County and the City of Bellingham as nothing else could possibly do. It has caused the

of the Chamber of Commerce, composed of business leaders of Bellingham. This work was so thoroughly endorsed by the Chamber board that they authorized the publication of some 10,000 copies of the brochure in three colors with a continuing and aggressive promotional program developed to make their silent salesman effective.

A special "Town Meeting of the Air" was organized and produced with the cooperation of the State Radio Chain and the power company, dramatizing the group action program under way and presenting plans for the expansion of local industry, as a report to the community and the state.

The Bellingham Chamber of Commerce is now carrying out an aggressive sales promotion plan for new industries, mailing the brochure to a selected mailing list of names of some five thousand industrial executives throughout the country. In addition to this broadcast mailing to selected industries, the Chamber of Commerce has organized a plan whereby local executives of banks, branch offices, the power company and others will send copies of the brochure with a personal letter to business associates and personal friends in industry who would find advantages in expanding their operations to this area.

The group action program originated by Bellingham has now been taken up by other principal communities served by Puget Power. Eight other industrial areas have now set up their inventory committees and are in various stages of progress on this project. The power company's efforts on industrial development do not stop here. In cooperation with three other principal privately owned utilities of the state, they have carried on a continuing national advertising program, now running in its second year. In preparation is a complete industrial inventory of the area served by Puget Power.

This activity is supervised and coordinated by the industrial development section of the general sales department. Frank McLaughlin, president of Puget Power, has this to say relative to this program: "We consider this industrial development program one of our most important activities. The industrial prosperity and expansion of the territory we serve is essential for expanding sales of electrical energy to all classes of customers. Experience shows that each dollar of industrial power revenue will support an additional three to four dollars of domestic, commercial and institutional revenue. This activity has proven a splendid means of cementing a firm partnership with all segments of the area served—industry, business, labor and agriculture—since all these groups have a real and compelling interest in the expansion of industry and community income and prosperity."

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lay citizen of Bellingham to recognize the true value of a chamber of commerce in the community. The work has stimulated business men and industrial men of the community to take a greater interest in community affairs. Even if no new industries are developed as a result of this study, the publication of the brochure has been worth the money in self-stimulus to Bellingham and Whatcom County.'

"The following are items of local expansion, many of them directly related to the industrial survey, with evidence of tangible job-created results:

"1. Pacific Coast Paper Mill has started a $250,000 expansion program designed to increase its production of paper and use of local pulp by 25 percent, and employ 35 additional employees.

"2. A cold storage plant advocated by the survey is now under construction. The facilities will handle fish, principally, and approximately 15 additional employees will be involved.

"3. Negotiations are now under way with a large out-of-state fish company to build a receiving center with cold storage facilities designed to handle fish received from Alaskan waters, which was one of the headline parts of the survey.

"4. In the wood products field, the Forrest Furniture Co. is now developing an expansion program which will provide jobs for an additional 150 employees.

"5. The Tank and Steel Co. has taken over the old shipyard location and is now building steel barges for the Alaska fishing industry, with a payroll increase of approximately 25 percent.

"6. A new, modern 40,000-board-foot saw mill is being built on the port fill, which is one of the industrial site locations discussed in the survey. This will employ some 25 workers.

"7. As a result of the agricultural survey, local farmers are now organizing a berry association for the purpose of stimulating the growing and marketing of this expanding industry.

"We have, of course, many new industry prospects, both local and from outside the state, and there are new inquiries coming in, not only to our company but to the Chamber of Commerce at Bellingham and other communities. Many of these are in the confidential negotiating stage and we feel that Bellingham has an excellent opportunity for these prospects because they have the facts which new industries want to know."

Silver to Silver for Fixed Contacts

Silver surfacing, while neither panacea nor vitamin, answers copper oxidation problem—Discussion of current-carrying aspect—Five techniques available—Bolted cleaved copper equal to silvering—Temporary jobs can be done with portable plating outfits

H. H. RUDD, Vice-President, Railway & Industrial Engineering Co., Greensburg, Pa.

SILVER SURFACING of fixed contacts does afford an answer to the problem of copper-surface oxidation where it occurs. It has merit but it is not a panacea for all joint ills nor is it a form of vitamin that somehow "jazzes" up equipment so that it can do more work. It cannot make up for inadequate pressure nor can it overcome dirt contamination.

Classification of Contacts

Discussion here will be confined to the advantages and comparative merits of silver surfacing for fixed contacts and for those contacts of a movable nature in which non-arcing under current interruption is not the major factor involved. The remarks are confined to the benefits of silver surfacing in maintaining good current-carrying qualities at fixed contacts.

1. Fixed contacts may be bolted or clamped.

2. Moving contacts may have focus on opening or closing and—

a. carry rated current and interrupt at no current.

b. carry rated current and interrupt rated current.

c. carry rated current and interrupt specified overloads.

Rated currents can be subdivided into very small (perhaps up to 100 amperes), medium (say 100 to 1,000 amperes) and heavy (1,000 to 10,000 or more amperes). Light auxiliary switches, relay contacts fall in the small-current class. They have unique problems such as making and breaking a small number of times or a great many times; they may make and break under load. They are not germane to a fixed-contact discussion nor are the situations requiring special designs and materials to withstand arcing.

Oxidation of Copper

Copper is subject to oxidation and when it is oxidized it will have an appreciably higher contact resistance, and trouble from overheating may result. The oxidation has a time-temperature characteristic. There is no one temperature that can be stated as the oxidation point. Copper at moderate temperatures will oxidize if the time is long, or if the temperature is high, oxidation can occur in a comparatively short time.

Everyone is familiar with the standards of a 30-deg. C. rise above a 40-deg. C. ambient for copper bus and air devices generally. With a total temperature of 70 deg. C. it might be years before copper would be oxidized. Also 40 deg. C. is only 104 deg. F. and there are many sections in a station where the ambient exceeds that value.

With the trend to enclosure of bus and equipment, the load losses in the bus and equipment itself make for a higher ambient, which means a total operating temperature of much more than 70 deg. C., and oxidation troubles will start.

Silver

Silver has the feature of not oxidizing at normal temperatures and at temperatures considerably in excess of those normal temperatures. Just what the safe limit is for the operation of a silver surfaced device has not been determined—it is known it is 15, 25 or even 50 deg. more than for copper.

In A.I.E.E. No. 27 Standard for Switchgear Assemblies, there is a paragraph that bears on the subject under discussion, as follows:

"27-252 Enclosed Switchgear—Enclosed switchgear shall be so designed that the average air temperature inside any compartment of the enclosure shall not exceed 15 deg. C. over the ambient air temperature outside the enclosure when all parts of the equipment are carrying rated current.

"The temperature rise of busses and connections when carrying rated current shall not exceed 30 deg. C. over the ambient air temperature outside the enclosure unless all conducting joints and terminal connections within the enclosure are brazed, welded, silver-soldered, soldered when separately held mechanically, and all contacts silver-surfaced or equivalent in which case the temperature rise shall not exceed 30 deg. C. over the average air temperature inside the enclosure."

This indicates that if silver surfacing is used the ambient may go up 15 deg. and the total temperature increase from 70 deg. to 85 deg. C. In a bus with no enclosure, that might mean an increase in load carried of, say, 20 percent.

In equipment devices such a general overload factor could not be used because of the particular shape and current distribution that might be employed. What additional load can be carried because of silver surfacing or to what total temperature silver surfaces can be carried is not yet fixed. Some work of a standardizing nature is to be undertaken by the A.I.E.E. in the post-war period.

Silver surfacing is a broad term which covers the following:

Silver plating—Electrolytic tank immersion.

Silver plating—Electrolytic brush type.

Silver—rivets and wire, inserts made integral with conductor material under high pressure.

Silver sheet amalgamated on.

Silver sheet brazed on.

Ordinary silver plating as used on good plated table silverware is of the order of 0.0005 to 0.0008 in. On this same good silverware, the parts that get the most wear are provided with extra plating or with silver insert. Where silver plating is used for bolted up contact surfaces, a very thin coating is allowable:—0.0002 to 0.0005 in. should be sufficient. On the Boulder bus there was a requirement of 0.001 in.

Where there is wear of contact closing and opening, it is felt that the thickness should be of the order of 0.002 to 0.003 in. to insure long life. For tank plating, if certain parts are to be plated it means other parts that should not be plated should be masked. If the masking is not carefully done the plating will go where it is not wanted and an expensive clean-up job is required. The work preparatory to plating must be clean, in fact extremely clean.

Brush Plating

Another form of silver plating electrolytically is the brush plating. The electrolyte is a liquid or paste. In this method a portable outfit is used. The big advantage of this method is that the parts to be silvered do not have to be disassembled and sent to a tank. A limitation is again the great necessity of getting the surface clean. There have undoubtedly been improvements in the past few years, but the thickness of plating in a reasonable time is very limited.

A few years ago we checked a demonstration operation and the time to do a 3x3-in. square was 20 minutes. The thickness of the coat, as near as it could be measured with a micrometer, was of the order of 0.0001 to 0.0002 in. It is easily seen that this method is not a factory production job. It may be very useful in plating parts right on the job without having to disassemble.

In trying out the brush plating, we made what we thought was a nice job. It had a beautiful silver mirror surface. Next morning we took another look—the silver had disappeared. It had apparently been absorbed. It is difficult to tell from the appearance whether a good job has been obtained.

Rivets, Amalgam

The method of silver surfacing by the use of rivets and wire inserts has proved very satisfactory where the method of forming uses enough pressure to insure a satisfactory and permanent bond with the conductor material.

The amalgam joining process is one that has to be carefully controlled because of toxic effects of mercury. This method did not prove to be all that was hoped for.

One of the more recent methods is brazing on to the conductor with Easy-Flo, or similar material, a sheet of silver on the place where silver is required.

Silver sheet can be purchased with a backing of Easy-Flo which simplifies the operation. Resistance and flame brazing are used, depending on the size and nature of pieces to be handled and manufacturing facilities and setup. The sheet is 0.010 in. thick. Sheet of 0.005 in. can be obtained, but it crinkles more easily. It is more difficult and more expensive to use.

There are some materials such as Gibasloy, which is a sintered mixture of silver and nickel and has advantages for certain kinds of moving contacts. It can be readily brazed to conductor material.

Good Copper Joints

We have looked at a number of unsilvered bolted surfaces that have been in service for many years and we find that the surfaces under the bolts are clean. They are clean because the copper is in such intimate contact under the bolts that there has been no oxidation. As a matter of fact, we have made some tests on bolted-up silver surfaces and bolted-up clean copper surfaces and have run them for long periods of time and at very much increased temperatures—about 6 weeks at 120 deg. C. We have failed to find that the copper to copper contacts showed up any worse than the silver to silver contacts, or to put it another way, there was no improvement of silvered bolted surfaces over bolted copper to copper surfaces.

Another statement might be made and that is that the surfaces not immediately under the bolts are not under very much pressure because bolted surfaces in contact for some time show clean under the bolts but oxidized in other parts. The natural conclusion then is to state that a lot of the old draw-file finish requirements for bolted-up copper contacts made a lot of needless effort. Copper is so soft that even if the total area of surface is beautifully cleaned and draw-filed there will still be oxidation on the copper which is not under the bolt pressure.

Wherever we are asked to supply silvered surfaces for bolted-up connections, we braze on a silver washer around the bolt hole. We then know that the silver is being used in the place where the pressure makes the contact.

Field for Portable Outfits

Though it might seem from the above that we do not think too much of a thin silver surface, we do believe that there is a field for the portable silver plating outfits that have been put on the market in the past few years. The big advantage of these portable plating outfits is that the device can be taken to the work and it may not be necessary to undo a lot of connections and tear down equipment just in order to put on a small amount of silver plating. There are probably many switches, which due to higher ambients than were contemplated or higher loads than were contemplated, have shown increased temperature rises. In such cases silver plating, even though very thin, may prove to be a good temporary expedient, depending on the amount of use and wear.

Silver Composition

The terms fine, sterling and coin are used in referring to silver: fine silver is 99 percent silver; sterling silver is 92.5 silver, 7.5 copper; coin silver is 90.0 silver, 10.0 copper.

Fine silver is generally used for silver surfacing.

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New Lamp Packaging Unit

A new lamp bulb package, which will enable housewives to take home an assortment of lamps in a single easy-to-handle unit, has been developed by the Westinghouse Lamp Division, Herbert E. Plishker, advertising and sales promotion manager of the Bloomfield, N. J., plant, recently announced. The new carton holds two each of the 40, 60 and 100-watt size lamps.

New Frontiers Theme of A.I.E.E. Winter Sessions

Conventioners inspired by vistas opened up by discussion of nuclear energy, industrial application of radar and other wartime developments —Groups, meanwhile, continue canvass of protective devices, excitation systems, transmission, measurements and hydroelectrics

"NEW FRONTIERS" was the theme chosen by the Technical Program Committee for the Winter Convention sessions in New York, January 21-25, 1946, and the discussions very definitely carried out the objective. Resumed development of deferred projects along with now-released secrets of the war provided the substance for most of the conferences and formal paper gatherings.

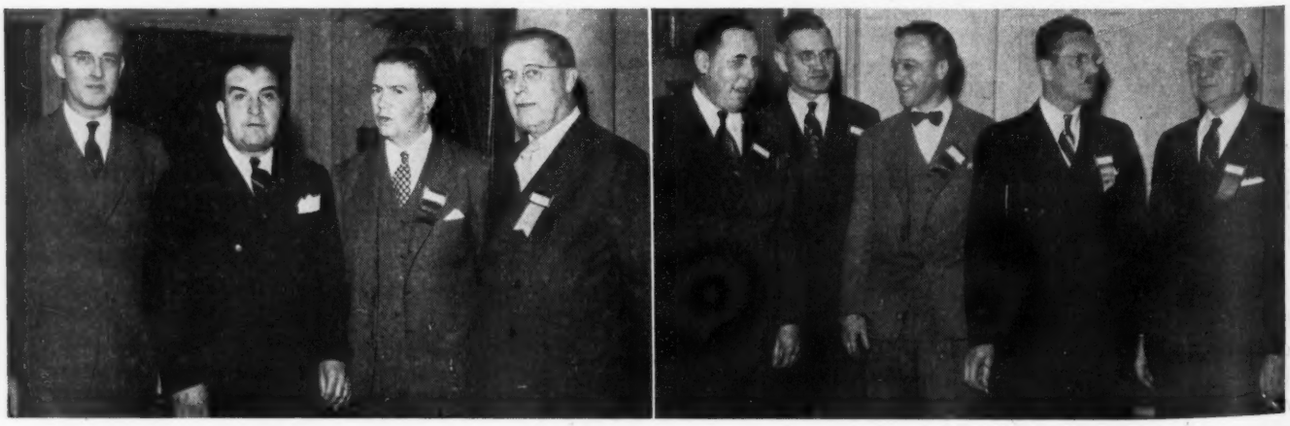
Just what will the arrival of nuclear energy do to the electric power industry generally, and the electrical engineering profession in particular? That was a major "new frontier" theme setup by Morris Hooven's technical program committee and it commanded large audiences at each of the three sessions devoted to it. One could come away from all the masterly discussions with a feeling that steam power is secure for years to come, but that eventually it may have to yield to direct conversion of nuclear energy into electrical. Conservative optimism marked the arguments and the portrayals but woven all the way through was the realization that electric power has had new zest and fresh glamor added to attract the enthusiasm of youth. As Dr. Dunning put it in the keynote address of the convention, "electrical engineers have built their careers on the electron; from now on they had better keep a weather-eye on the neutron." High points of five other contributors will be found under the subheading "nuclear energy."

Industrial Topics

Industrial discussions commanded a larger than usual share of the convention discussions; there were three sessions, mostly informal in character to afford free play of intimate experiences on the part of the industrial engineering membership. Two reports were submitted, a preliminary one on industrial voltage requirements and a definitive one on machine tool and process drives.

Typifying the flavor throughout was an off-the-record session devoted to new industrial uses of electronics resulting from war-time developments. Doubt about the practicable application of radar equipment, for example, was largely dispelled by citation of the characteristics of hydrogen thyratrons as a substitute for rotary and enclosed gaps for momentarily high output pulsing. Tubes of astonishingly small physical dimensions were said to be available for peak outputs of up to 2,600 kw. for sealing glass, welding, electroplating (without depolarization), plastic preheating, etc. Correspondingly high voltages and peak outputs are available in the magnetrons which are promised to be applicable for similar uses. Meanwhile, there is a tendency to pause in seeking new applications of high frequency heating while filling out the kw. and frequency gaps in equipment lines already developed.

Registered attendance reached the record breaking value of 2,580.



CONVENTION COMMITTEE MEMBERS—G. J. Lowell, R. T. Oldfield, C. T. Hatcher, H. E. Farrer, C. Frei, J. L. Callahan, H. H. Heins, C. S. Purnell, L. F. Hickernell

Nuclear Energy

Interest in the vista opened up for electrical engineering by the achievement of atomic fission on a large scale was manifested by the heavy attendance at the Friday morning symposium on the subject on the heels of the Wednesday discussions by Professor Dunning, Edison Medalist Sporn and Major General Groves. Dr. Dunning had declared that the harnessing of atomic energy will become possible when metals capable of withstanding the high temperatures are developed. Some day the cheapened cost of U-235 will let it displace coal as the fuel in big power plants, "but the boiler for the job has not even been designed," said Sporn in accepting the medal. He and Dunning both emphasized the heavy shielding needed to safeguard workers, the weight of shield making anything but large marine or land stations unfeasible. Also, it takes more than two pounds of material before the chain reaction becomes self-sustaining due to the escape, otherwise, of the neutrons that maintain the process. Barium and cadmium control rods can be used as moderators to regulate the rate of "combustion."

A very significant statement by Dr. Dunning was that "later it may be possible to convert atomic energy directly into electrical energy (presumably at high voltage) without use of turbogenerators." He did not elaborate on the point but did say that it is awfully sad to contemplate the terrifically high temperatures available from nuclear fission and still not foresee how their potentially high thermal efficiencies can be realized.

At the symposium session Dr. K. K. Darrow (Bell Telephone Laboratories) refreshed the audience of 400 on the physics of fission and urged all engineers to watch the evolution of the pile process, saying "it has great import for civilization." Dr. C. G. Suits (General Electric Director of Research) likened the pile to a stoker-fired boiler in which fresh fuel must be added and the waste products of the heat-release operation removed. Today the heat obtainable from the pile (the temperature is limited by the structure and the shield) is not competitive with conventional fuels. He joined Dr. W. E. Wickenden (President of A.I.E.E.) in cautioning that commercial availability of nuclear energy is not going to make electrical energy greatly cheaper than at present. He believes that the significance of fission in the field of power application will continue to overshadow the merits for chemical and biological application.

J. J. Orr, U. S. Rubber; James Murray and Michael Carlson, I-T-E Circuit Breaker; V. P. Hessler, University of Kansas; Dick Cox, I-T-E Circuit Breaker

Philip Swain (*Power*) added that if the pile-process temperature is not feasibly high enough to generate steam at prevailing temperatures and pressures, comparatively small quantities of conventional fuels can be utilized to superheat the steam for the sake of efficiency. Dr. Joseph Slepian (Westinghouse) joined in the well-balanced conservatism and optimism which he saw in the Suits and Swain talks and agreed with them that the confinement of the potentialities of uranium isotopes exclusively to heat release very definitely limits the impact on power plant operations. He intimated that hope should be held out for direct conversion of nuclear energy into electrical form. Right now the big deterrent is the cost of enrichment of U-235 but here again he looks for much progress in the field of isotope separation.

Excitation Systems

Excitation Systems for Synchronous Machines. S. B. Crary and J. B. McClure (both General Electric).

Enumerates requirements, offers terminology, outlines general specifications and compares excitation sources.

Excitation Systems for Turbine Generators. M. D. (Westinghouse).

Tabulates comparative merits of 8 systems including pilot, Rototrol, motor-generator, house turbine and ignitron electronic, the latter promising to become competitive with the larger rotating regulating exciters.

Motor-driven Exciters for Turbine Alternators. R. B. Bodine, S. B. Crary and A. W. Rankin (all General Electric).

Criteria for decision and design for Dayton 30,000-kw. turbogenerator; appropriateness facilitated by station and interconnection reliability. Looked upon to supplant 3,600 rpm. direct-connected exciters.

Application and Performance of Electronic Exciters for Large A.C. Generators. H. A. P. Langstaff (West Penn), **H. R. Vaughan and H. F. Lawrence** (both Westinghouse).

Tests on model answered criteria favorably. Unit next tried out on any of several paralleled generators. Dependable, installed anywhere, easy to maintain, high speed of response, easily adaptable to voltage regulation, relaying unaffected. Primer excitation needed for independent generator.

Electronic Generator Voltage Regulator. J. E. Reilly and C. E. Valentine (both Westinghouse).

Regulated voltage balanced against reference voltage built into electronic-tube regulator circuit. Suitable for application of thyratron exciter, field of main exciter or for firing voltage of Ignitron exciter.

The Design of an Electronic Exciter for Large Generators. W. R. Farley and G. R. Marcum (both Westinghouse).

Delta, 6-phase star off auxiliary bus; 3 groups of 2 ignitrons, each with anode breaker; anode firing excitation of ignitrons; details of auxiliaries.

Trend to greater reliability of large generating units, particularly in unit plant assemblies and particularly because of the 3,600 rpm. speeds, this

Front Row—R. W. Wilbraham, United Engineers & Constructors; F. R. Fairchild, Public Service Electric & Gas of Newark; J. K. Ostrander, United Engineers & Constructors; F. R. Frishette, Appalachian Electric Power. Back Row—P. H. Adams, Public Service Electric & Gas; J. B. Harris, Rumsey Electric; R. E. Anderson, Delta-Star Electric; H. O. Sauer, Consolidated Gas Electric Light & Power Co. of Baltimore

symposium was set up as explained by Chairman Krupy. Quite naturally, the opposing schools of thought collided, but on the whole, there was the constructive spirit that presages moves toward standardizing the terminology and the requirements and specifications of the excitation art. Much of the discussion on the first papers indicated that action in this direction was needed but that many comments would be filed before any commitments to paper could ensue. There was pro and con comment on the inclusion of the voltage regulation function in the excitation prescription.

Advocacy of the motor-driven exciter in the Bodine-Crary-Rankin paper was countered by Clarence Lynn's (Westinghouse) assertion that the only reason for resorting to a motor-driven exciter would be to guard against a failure of a shaft exciter necessitating the shutting down of the turbogenerator. He said the recent improvement in the 3,600 rpm. exciters have given them reliability approximating that of the main unit. J. F. Miller (General Electric) felt that commutators at high speed do not perform well under vibration conditions unless aided by the new brushes and brush holders now available. Asserting that one-fifth the outage minutes on a system are due to minor troubles and the rest to circumstances of a calamity nature, F. W. Gay (Public Service Electric & Gas) asked how a motor-driven exciter can contribute anything toward getting back into service in those 4-out-of-5 cases where trouble is system-wide. J. B. McClure (General Electric) said the customer was free to pick what he deems best since the various rotating exciter schemes come to practically the same cost, less, incidentally, than the electronic exciter.

There has been no operating experience yet with the electronic exciter at Springdale, said Langstaff, adding that the operating date is likely to be mid-February. F. M. Porter (American Gas & Electric Service Corp.) cited the 100 years of service life of electronic exciters and regulators installed on the A.G.&E. system and said his associates are convinced that the applications are no longer to be viewed as in the experimental stage. All have given generally good performance, particularly since the initially high tube mortality has been corrected, largely by the substitution of the sealed ignitrons for the earlier pumped vacuum units.

Industrial Power Applications

Combined Light and Power Systems for Industrial Plants. D. L. Beeman. (General Elec).

Concludes that there is economy in the combined systems. Recommends 480/277-volt substation supply for 260-volt 2-lamp lighting; also separate transformers for resistance welding loads.

Induction Heating of Long Cylindrical Charges. H. F. Storm (Allis-Chalmers).

Mathematical analysis for any radius of charge and depth of penetration with nomogram for the latter under various resistivities and permeabilities.

Application of the Betatron to Practical Radiography. J. P. Girard (Allis-Chalmers) **and G. D. Adams** (Univ. of Ill).

Magnetic acceleration detailed. Optimum is 20 million electron volts. Flaws detectable in 20-in. steel.

Commenting on the Beeman paper, C. R. Johnson (U. S. Rubber Co.) and L. C. Peterman (Ford, Bacon & Davis) indicated that while it was entirely practical to supply lighting circuits with 260 v. (2-lamp lighting) there must always be a 110-v. supply for incandescent lighting, convenience receptacles, and motor driven hand tools, etc. R. H. Kaufmann, (General Electric) recognized the need for 110-v. service, but felt the inclusion of a 110-v. service would not materially affect the economy of the 260-v. lighting supply, especially when it is realized that the lighting load in modern plants represents approximately 40 percent of the total volt-ampere per sq. ft. load.

High Frequency Heating

In expressing the conference's appreciation to H. F. Storm, J. J. Orr (U. S. Rubber) emphasized both the Institute's and industry's need for more expressions and papers on Induction Heating.

Expressions on the J. P. Girard (Allis-Chalmers) and G. D. Adams (University of Illinois) paper highlighted the potential industrial radiographic applications made possible by the betatron.

Discussing a modern industrial network installation, K. A. Fahse (International Harvester) described a plant covering approximately 46 acres which was served by utility company controlled substations, one a bank of 2,500-kva. transformers (three at 833-kva. single phase) and the other a 2,000-kva. transformer bank (two at 1,000-kva., 3 phase).

The secondary distribution was 480 v. An emergency tie line feeder connected the two stations.

When a new building of 134,000 sq. ft. floor area was erected it required a connected power of 10 volt amp. per sq. ft. Space was provided for four distribution substations, one in each corner of the building. Three of the stations consisted of a 750-kva., 3 phase dry-type air-cooled transformer with a 11,500-v. delta connected primary, and a 460-volt delta connected secondary with a 1,600-amp. network protector and a 3-position primary selector switch interlocked with the protector. In the fourth substation, provision was made so that switchgear could be connected to an additional transformer when more capacity was required.

From experience with a similarly designed plant distribution system Mr. Fahse expected continued favorable results.

Industrial Voltage Conference

Dielectric Strength and Protection of Modern Dry-Type Air-cooled Transformers. P. L. Bellaschi and E. Beck (Westinghouse).

Analysis leads to recommendations for line arresters at cable-line junction and machine arresters at cable-transformer junction.

Informal papers were presented, including the Interim Report by A.I.E.E. Committee, on Industrial Power Applications. Analysis of report and following discussion indicated a widespread desire of operating engineers for closer voltage regulation from supplier. Only a small minority is willing to continue to accept variations in excess of 5 percent. A large percentage is anxious to narrow limits to $2\frac{1}{2}$ percent or less. There is no basic conflict between user and supplier and close cooperation between them will result in an understanding of each other's problems. Survey shows voltage maintained at delivery point in metropolitan districts and highly developed industrial areas often has a spread of only 1 percent to 3 percent. In less developed areas a 5 percent or more spread is common.

In discussing 2,300 volts vs. higher voltage for industrial plant generation and distribution, R. H. Kaufmann (General Electric Co.) illustrated with break-down cost chart that, with few exceptions, a 4,160-v. distribution potential is more economical than 2,400 v. Mr. Kaufmann pointed out that while motors of 200 hp. or less should be served at 440 v., those of higher rating can be served directly with 4,160 v. For large plants (25,000 kva.) and distribution distances of more than 4,000 ft. it would be better economy to distribute at 13,800 v.

Discussion of grounding neutrals of industrial power systems by L. G. Levoy, Jr. (General Electric Co.) developed that grounding of neutrals of systems with 2,300 v. and below is becoming more common. Systems with ungrounded neutrals are having operating and maintenance problems which can be minimized by grounding.

Protective Devices I

Field Tests of Interrupting Capacity of 138-Kv. Oil Circuit Breakers. W. B. Buchanan and G. D. Floyd (Hydro-Elec. Power Comm.)

Details of preliminary studies and meticulous preparations for successfully-controlled fault tests; margin of 60-cycle breakers reduced on 25 cycles.

A New Line of High-voltage Outdoor Tank-type Oil Circuit Breakers. W. F. Skeats and E. B. Rietz (both General Electric).

Reports improvements and extension to 230-kv. of the 3,500 mva. 161 kv. 3-cycle (20-cycle reclosure) breaker previously reported. Size and weight reduced.

Dielectric Recovery by an A.C. Arc in an Air Blast. T. E. Browne, Jr. (Westinghouse).

Discussion of configuration for optimum orifice efficiency; hypotheses accounting for random variations in dielectric recovery.

Long Sixty-cycle Arcs in Air. A. P. Strom (Westinghouse).

Studies covered currents up to 21,750 amperes and lengths to 48 in. All gradients fall between 21.5 and 50 volts per inch, mostly 31 to 38.

G. D. Floyd (Hydro-Electric Power Commission of Ontario), in discussing the paper on tests, stated that the ASA standards had been adhered to and that the tests revealed certain weaknesses in these standards. He feels that there should be no place in the standards for personal interpretation of the results, but rather that it be a pass or not pass, as is the case for instance in the generator short circuit test.

Several interesting comments were made on the magnitude and scope of the tests and A. W. Hill of Westinghouse raised the question of effect of frequency on arcing time. Since this was one of the largest circuit breaker field tests reported recently on a 25-cycle system, he hopes the authors will make this information available. L. B. Chubbuck (Canadian Westinghouse) revealed that there was no indication of arc spreading between phases at any time during the tests. H. P. St. Clair

J. F. Fairman, Consolidated Edison of New York; M. S. Oldacre, Commonwealth Edison; H. Pandhoefer and J. D. Hoffman, General Electric; H. C. Forbes, Consolidated Edison of New York; E. O. Shreve, General Electric

(American Gas & Electric) stated that field tests on multi-operational shots have shown breakers to be well within their name plate ratings and wonders whether the time hasn't arrived to eliminate the derating of OCB because of this experience.

W. R. Brownlee (Commonwealth & Southern) stated that operating companies need a great deal more information on the arc in the circuit breaker which more nearly approaches the volts per foot found in practice. Edwin W. Whitmer (American Gas & Electric), in discussing the bushings used in breakers. stated that it is perfectly natural to expect sealed bushings to develop leaks. Preference was shown for sealed bushings operating under greater than atmospheric pressure rather than those operating under various degrees of vacuum. M. H. Hobbs (Westinghouse) questioned the advisability of limiting the number of different capacities available to one per standard voltage. He would rather see two or three interrupting ratings per voltage depending upon the needs as found in the operating fields.

Protective Devices II

A New Submersible Network Protector of Higher Rating. G. G. Grissinger and F. D. Johnson (Westinghouse).

Rating upped to 3,000 amperes (40,000 interruption, breaker 90,000 for 60 cycles). Thermal design for heat minimization and dissipation.

The Development, Design and Performance of Magnetic-type Power Circuit Breakers. L. J. Linde (A. B. Chance Co). **and B. W. Wyman** (General Electric).

Arc cooling, movement and extension introduces progressively higher arc resistance as current zero approaches.

Metal-clad, Unit-type Switchgear for 33-kv. Service. C. H. Kreger (Pub. Serv. of No. Ill.).

Strong endorsement based on 13-16 years favorable experience. Evolutionary troubles detailed. Installed cost third more than open type. Reliability and safety established. Continued evolution urged.

New Series Capacitor Protective Device. R. E. Marbury and J. B. Owens (Westinghouse).

Graphite gap in conjunction with thermally-operated bypass switch prevent undue rise of voltage across capacitor on faults.

Size Reduction and Rating Extension of Magnetic Air Breakers Up to 500,000 Kva., 15 Kv. R. C. Dickinson and Russell Frink (Westinghouse).

Voltage limit of interrupter increased by use of shading coil creating phase shift between arc current and the field flux.

H. V. Nye (Allis-Chalmers) stated that C. H. Kreger (Public Service of Northern Illinois) had proven in the seven installations that the unit type switchgear was applicable to 33-kv. service. He stated that the future of this type of equipment depends upon the utilities taking advantage of the equipment's inherent advantages. He continued with the statement that all manufacturers must depend upon the utilities for guidance in applying metal-clad, unit-type switchgear for 33-kv. service.

There can be no discussion on the increased safety and reliability obtained by adopting metal-clad to these higher voltages, stated M. H. Hobbs (Westinghouse), but there may be some question on the factor of economy. He stated that metal-clad type costs would approximate 30 percent above the open type, but that this does not consider several intangibles. He added that the industry was indebted to Public Service of Northern Illinois and hoped studies would continue.

The possibility of using indoor-type metal-clad units when inclosed in an inexpensive housing was one of the questions brought up by H. A. P. Langstaff (West Penn Power). He also believes there are many applications and consequently a wide market for this type of breaker capable of interrupting from 250,000 to 500,000 amp.

M. H. Hobbs (Westinghouse) made a comparison between magnetic air-breakers, stressing the differences brought about by the graduated magnetic strength found in various parts of the arc chutes. B. W. Wyman (General Electric) stated that one of the important points to consider in designing a magnetic breaker is to have the movement of the arc in the chute rapid enough to prevent too high a rise in temperature. R. C. Dickinson (Westinghouse) stated that the magnetic air-breakers up to 500-kva. capacity operating at 15 kv. under development had withstood 105 operations at 3,000 amp. within a short period of time and that the breakers were in good operating condition.

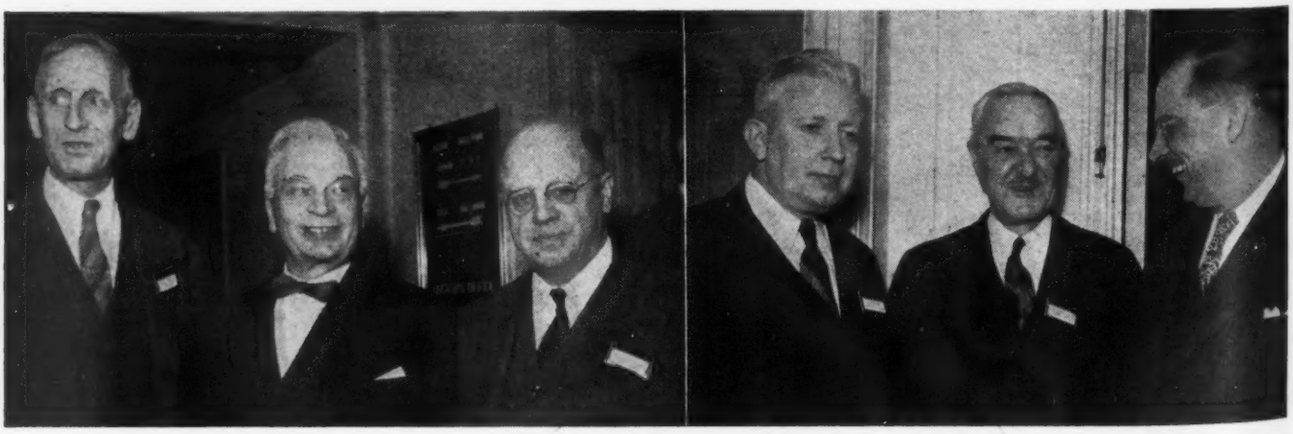
Power Transmission

Lightning Performance of 220-Kv. Transmission Lines—II. Lightning and Insulator Working Group (A.I.E.E.)

Analyses answers by 13 companies with 6,601 miles of circuit. Characteristics (56) tabulated and interpreted. Overhead ground wires confirmed. Small shield angles reduce outages. Flashovers even with 1,600-kv. impulse strength. Counterpoises predominant. Arcing devices now omitted.

Formulas for Conductor Size According to Cost of Resistance Loss. H. B. Dwight (Mass. Inst. of Tech.).

For utilities peak-load current dominates. For purchased kw.-hr. ratio of average loss to maximum must be considered. Formulas



P. H. Chase, Philadelphia Electric; S. H. Mortensen, Allis-Chalmers; F. S. Brown, Duquesne Light; E. C. Woods, Public Service of Indiana; A. Camp Streamer and A. C. Montieth, Westinghouse Electric.

J. W. Milnor, consulting engineer; E. T. Carlson, Trumbull Electric; L. A. Burckmyer, Cornell University

include insulated copper and cored conductors as well as interior wiring.

Arcing Ground Tests on a Normally Ungrounded 13-Kv. Three-Phase Bus. J. E. Allen and S. K. Waldorf (Penn. Water & Power).

More than tripled normal voltages not produced; rapid quenching of arcing ground not likely to take place; several types of protective gaps tried out.

Formulas for the Inductance of Coaxial Buses Comprised of Square Tubular Conductors. H. P. Messinger (Allis-Chalmers) **and T. J. Higgins** (Ill. Inst. of Tech.).

Generalized 36-term expression is simplified for practical application into two approximate forms. Correction factors for round edges and for skin and proximity effects. Comprehensively mathematical.

Several men recommended that when operating an underground bus an insulation strength of at least three times that necessary for phase-to-ground voltage be utilized for safe operating practices. T. J. Higgins (Illinois Institute of Technology) stated that he believes that coaxial buses have great advantages in high frequency service because of the resulting low inductance.

M. S. Oldacre (Commonwealth Edison) stated that the ground wire used in conjunction with the low resistance ground is still the most important factor to consider in obtaining good lightning protection. He believes that the reliability of the line should be equal to that of the generator. In discussing line outages, he stated that in many locations dirty insulators cause more outages than does lightning. He added that there is still a fertile field for studying over-all outages with a great deal of emphasis put upon sleet, dancing conductors, etc.

Stating that many lines are now overinsulated, A. E. Davidson (Hydro-Electric Power Commission of Ontario) would like to see some of these lines tried out at nearer their insulated strengths in order to ascertain what outages would result. H. N. Ekvall stated that the Philadelphia Electric Co. has installed 30 cross bonds between towers and that since this was done only one outage has resulted due to lightning. W. S. Peterson (Department of Water & Power, Los Angeles) stated that the use of gaps to study the location and the currents involved in lightning discharges showed that the total number of strikes for several years were logged as 158, 91, 138, 218, 161, 70, 201, 187 and 185. In these only two caused flashovers. The magnitude of the currents involved in these two did not appear to be heavy, but the outage was believed to be caused by the lightning coming into the conductor from the side.

Power System Relays

Protection of Pilot Wires from Induced Potentials. R. B. Killen and G. G. Law (The Dayton P&L Co.).

Experience with false trippings and alarms prompted design following pattern of A.T.&T. acoustic shock suppression, comprising drainage coils and gaps.

Linear Couplers—Field Tests and Experience at York and Middletown, Pa. E. L. Harder and E. H. Klemmer (Westinghouse) **and R. E. Neidig** (Metro. Edison).

Astatic air-core mutual reactors provide adequate relay energy without risk of saturation; superior to oversize C.T. and multi-restraint relays. Fast clearing, one relay per phase, circuits simple, cost competitive. No incorrect operations.

Application of The Ohm and Mho Principles to Protective Relays. A. R. van C. Warrington (General Electric).

Details for one-step distance, directional time O.C., three-step, X distance, and mho distance for mho relay; out-of-step, reclosing and carrier use of ohm relay. Relay circuits simplified.

The Mho Distance Relay. R. M. Hutchinson (General Electric).

Each of three units has mho characteristic, provide 3-step distance phase protection to one terminal. Feasible for pilot carrier. Strong polarization for zero-voltage fault.

Discussion here focussed on the place of the mho relay in system protection as contrasted with the earlier impedance and still earlier reactance relays for long line duty. Expressed in terms of circle diagrams, the mho relay is the circle with the smallest diameter and, therefore, that much more out of reach of vagrant power swings. Hutchinson showed this and pointed out that tilt of the circle and introduction of "side boards" could further render the relaying positive on true fault and oblivious of mere swings. Also, the mho relay is inherently directional, thus avoiding any need for supplementary directional devices.

W. R. Brownlee (Commonwealth & Southern) feared that the "wandering" of the circles might prove a dubious asset and decried somewhat the degree of dependence on voltage in the functioning of the relay. As for out-of-step blocking, he reminded the authors that out-of-step phenomena are far from smooth in nature. He favored a carrier scheme to distinguish between fault and swing, in effect relying on circles at either end of the protected zone, in which case the swing orbit would have to enter both circles in order to trip when so policed by carrier. C. A. Streifus (Ebasco Services) reported several board studies in which the side board explained by Warrington appeared to have merit in delimiting the swings. There were cases where the swing as viewed by the mho relay at one end of the protected zone would move into the circle but away from it at the other end: he deemed this a field for the single side board.

Successive development of the reactance (x) and impedance (z) relays, said L. F. Kennedy (General Electric),

had not taken quite enough cognizance of arc resistance. The mho relay is just another form of the same ohm principle and which one is appropriate is a matter to be decided on the relative weights of elements in the line, load and fault characteristics. Warrington had intimated that the reactance relay had merits for the shorter lines, the impedance relay for the intermediate ones and the mho relay for the longer and more fully loaded lines.

Use of a neutralizing transformer was cited by a representative of Long Island Lighting as a means of preventing induced potentials on pilot circuits, the lessor being averse to use of gas-filled tubes. Killen said the neutralizing transformers would, in the Dayton instance, have had to be cascaded in several stages to hold the induced voltage within bounds and this was not a feasible procedure.

Two preliminary committee reports marked another informal conference on power relays. One pertained to relaying of power house auxiliaries and the other to differential protection of power transformers. Significant in the unrecorded discussions was a tendency to be somewhat perplexed by the lukewarmness toward pressure type relays despite the acceptance and use of such devices in Europe and Canada in tripping transformers in the incipiency stage of faults that cause a rise in above-oil gas pressure.

Instruments and Measurements I

The Measurement of Large Varying Currents. A. C. Johnson (E. G. Budd Mfg.).

Hollow cylindrical shunts maintain proportionality of shunt current to measuring-circuit current at each instant even at 2 x 10^8 ampere-per-second rates of change.

Electronically Balanced Recorder for Flight Testing and Spectroscopy. A. J. Williams, Jr., W. R. Clark and R. E. Tarpley (all Leeds and Northrup).

Fast balancing (1.0 to 1.5 seconds); slide-wire balanced by induction motor powered from 6L6 tube. High Z input circuit available through elimination of conventional input transformer.

Electrical Analogy Methods Applied to Servomechanism Problems. G. D. McCann, S. W. Herwald and H. S. Kirschbaum (all Westinghouse).

Transients analyzer solves fundamental problems of complex response. Tabulation of formulas for converting mechanical factor into electric circuit equivalents.

Stress Measurement by Electrical Means. R. E. Kern and S. B. Williams (both Curtiss-Wright).

Electrical measuring circuits for the bonded-wire gage. Appropriate instruments indicated for five brackets of frequency response up to 20,000 c.p.s.

Instruments and Measurements II

Thermal Demand Meter Testing Techniques. E. E. Lynch and M. E. Douglass (both General Electric).

To shorten the time for testing and facilitate on-premise tests three methods are proposed and discussed; (1) Two-point-on-a-curve, (2) Double-load application for specific period, (3) Thermal (reference) standard meter.

Peak Voltages Induced by Accelerated Flux Reversal in Reactor Cores Operating Above Saturation Density. Theodore Specht and E. C. Wentz (both Westinghouse).

Mathematical analysis of series transformers under hundred-times normal currents. Treats current transformers and tap-change preventive auto transformers under fault conditions, street light transformers with dead lamp.

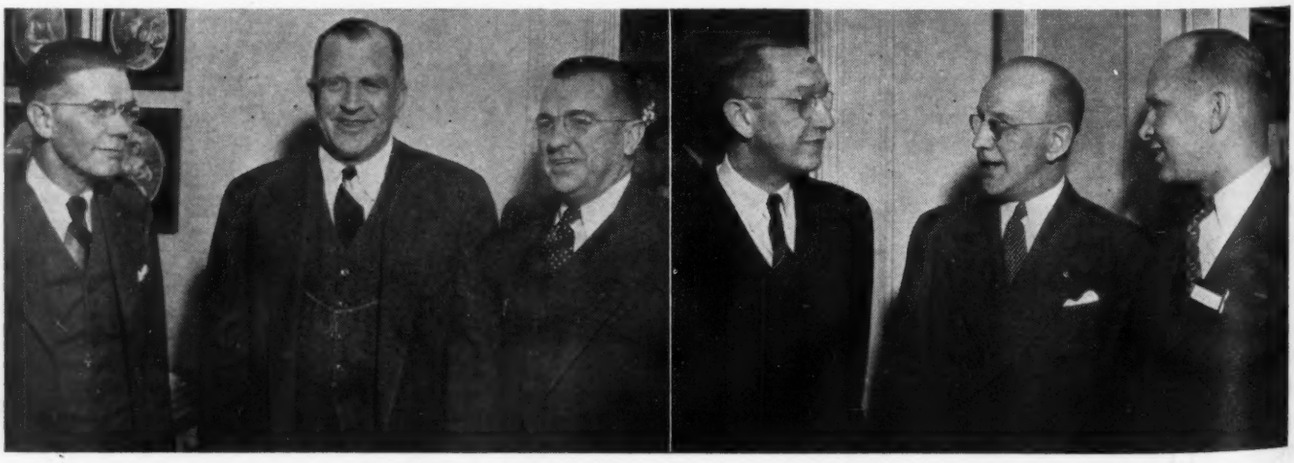
An Automatic Oscillograph with a Memory. A. M. Zarem (Cal. Inst. of Tech.).

Photograph of persistent fluorescence records events occurring previous to opening of shutter. Forty sets recorded automatically.

Discussion at the first "I&M" session was largely confined to the servomechanism paper. McCann admitted that it was not an exhaustive report and that only the beginning had been made in studying the steady state characteristics of the mechanisms on the A.C. calculating board. G. S. Brown (Massachusetts Institute of Technology) asked whether it would not be possible to extend the studies toward covering the problem of frequency response and backlash. Herwald responded by asserting that sinusoidal injections have been tried on the board and that the non-linear elements (that complicate some of the hydraulic and electromagnetic setups) are now being worked on.

Lack of recognition of the lifelong work of P. M. Lincoln in the field of thermal demand meters in the Lynch-Douglass paper was decried by P. A. Borden (The Bristol Co.). Lynch did recall that Lincoln had predicted the ultimate achievement of the simple logarithmic characteristic on which the prospect of shortened time of thermal demand meter testing depends.

The automatic oscillograph "with a memory" was built at Allis-Chalmers for non-attended study of the vagaries of rectifiers and it has proven quite useful because it entails no problems of synchronization or frequency-response limitation, said Zarem. W. Richter (Allis-Chalmers) emphasized the high film economy of the device and remarked that efforts to get longer



H. W. Collins, Detroit Edison; D. M. Simmons, General Cable; C. C. Farrell, Philadelphia Electric; H. R. Searing and J. J. Wittmer, Consolidated Edison of New York; Tom Fort, Westinghouse Electric.

"memory" by persistence of fluorescence usually involves the handicap of poorer actinity.

Two memory types of oscillographs have been built by General Electric since 1939, said C. M. Foust, and they have proven most useful where time of surge occurrence could not be known. An alternative is the use of a 1-microsecond delay cable to get the initial stages of the fault or discharge. A third alternative, wire-recording, was mentioned by Richter as having an upper frequency limit of 5,000-6,000 cycles per second.

Hydroelectric Systems

Supervisory Control of 30,000-kva. Hydro Plant. C. W. Bohner (General Electric) **and A. P. Maness** (TVA).

Overinsulated 51-pair telephone cable (2 supervisory, 23 metering, 13 spares) controls 30,000-kva. generators; 46 supervisory points. Cost of supervision, operation and maintenance $0.101 to $0.125 per megawatt-hour.

Technique of Electrical and Hydraulic Testing of Hydroelectric Units. G. D. Floyd and J. J. Traill (Hydro-Elec. Power Comm.)

Helpful comments on relative merits and idiosyncracies of tests of resistance, TIF, V-curves, load excitation, stability, losses, power output, flow (current meter apparently preferred) and head.

Various types of machine tests and factors affecting insulation life were the subjects brought out during the discussion. G. D. Floyd (Hydro-Electric Power Commission of Ontario) stated that it is absolutely necessary to break the coupling in making retardation tests. L. B. Stirling (Hydro-Electric Power Commision of Ontario) said that the use of a fibre rod in cleaning the air ducts on an open type machine and then blowing out with air results in a much better job than that obtained by merely blowing out the ducts. He questioned the yearly practice of varnishing the end turns on field coils since often all that is accomplished is the building up of varnish layers which thereby reduces heat radiation and consequently results in shorter insulation life.

A. H. Frampton (Hydro-Electric Power Commission of Ontario) expressed the opinion that the range of operating temperatures of the insulating materials is equally important with the height of operating temperatures as factors which affect insulation life.

Several engineers stated that one of the things needed is an insulating material whose life in generators would be equivalent to that now experienced in stationary apparatus. Continuing discussion on insulation life, R. T. Henry (Niagara Hudson) stated that varnish cambric in several machines on his system have given 44 years' service.

Coil insulations and the technique of testing these were brought into the discussion by J. T. Madill (Aluminum Co. of Canada) when he expressed the opinion that there is a great need for the better understanding of testing techniques.

F. W. L. Hill, Potomac Electric Power; Mark Eldredge, War Assets Corporation; C. R. Beardsley, Consolidated Edison of New York; C. T. Sinclair, Duquesne Light

Symposium on Lighting

Spending $15 million on an airport, and of that only $15,000 for lighting it, is all wrong, said W. A. Pennow, Westinghouse, in his talk, "New Frontiers in Airport and Airways Lighting." Such niggardliness in allowance of money for lighting has already caused losses in the millions for wrecked planes, not to speak of its toll in human injury and death. Considering progress in design of all types of airport lighting made during the war—for instance, an approach light of 5 billion beam candlepower is now available at low cost—there is no good reason for night landing to be anything but safe in any weather.

Infrared heating is still pretty largely a matter of cut and try, according to Edwin H. Robinson, Fostoria Pressed Steel, who spoke on industrial applications of this kind of electric heating. Temperatures up to 1,000 deg. F. are possible, he said. A coming development is control of heat applied to the work by variation of supply voltage.

There is need for specific nomenclature and for defined bases of quantitative statement of performance of germicidal lamps, said L. J. Buttolph, General Electric, in his discussion of advances in production and application of germicidal radiation. At present, for lack of a language of its own, the art of germicidal radiation must make use of the terms and quantities of visual radiation. Much progress is being made in characteristics of glass to allow more ultraviolet energy to come out of the lamp; at present a 30-watt lamp gives off about 6 watts in ultraviolet. The lamp has already amply demonstrated its effectiveness in destroying air-borne bacteria and it can be expected that applications will increase rapidly.

Development of the lighting art will not be hampered by any failure of glassware in either quality or quantity. That was the impression left by the talk of C. W. Clarkson, Corning Glass Works, on "New Glassware in the Services of Lighting," which was illustrated by a film showing the making of glass products, from handwork for special pieces to mass output of lamp bulbs so fast the eye can see only their flow.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Performance of Cooling Towers

From an article by C. H. Fielding in "Electrical Review," London, September 14, 1945.

PERFORMANCE OF a cooling tower can be judged most readily by comparing the temperature of the recooled water with the wet-bulb temperature, which is the lowest temperature to which water can be cooled by evaporation. A figure of merit can be computed as the ratio of the actual temperature drop of the water to the difference between the inlet and wet-bulb temperatures.

The design problem is to get sufficient cooling air to all parts of the water as it falls to the pond. The older wooden chimney tower was limited in performance by inability to give adequate penetration to the center of the stack if the width exceeded about 35 ft. As a result towers were made rectangular, the long sides presenting large surfaces to the wind and having a high overturning moment. For this reason the height rarely exceeded 90 ft., and necessary internal cross bracing interfered with the flow of air. Single towers not built in capacities of more than 500,000 gal. per hr.

The modern reinforced concrete tower can be built in units up to 6,000,000 gal. per hr. and can be designed to give much better air and water distribution. Owing to the greater heights permissible and lack of internal bracing a greater flow of air can be secured, thus permitting greater concentration or a lower final temperature of the water.

As a comparison, a certain station has four wooden towers 80 by 36 ft. with an 80-ft. chimney; the combined ground space is 13,900 sq. ft. The capacity is 1,000,000 gal. per hr., at the rate of 87 gal. per sq. ft. per hr. Adjacent to them are two reinforced concrete towers with a base area of 7,200 sq. ft. and cooling 1,900,000 gal. per hr. (twice the capacity in half the space) at the rate of 132 gal. per sq. ft. per hr. Together the six units have the performance indicated by the accompanying illustration.

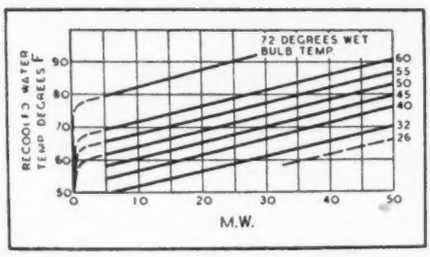


FIG. 1—Recooled water and wet-bulb temperatures obtained at various loads with four wooden and two concrete cooling towers

Irradiation Necessary in Sphere Gap Measurements

From a paper by J. M. Meek before the Institution of Electrical Engineers (British), November 23, 1945.

BEHAVIOR of the sphere gap is affected by irradiation, and its control is necessary if the gap is used as a measure of voltage. The position of the spheres relative to the impulse generator was found to affect the results, and may explain discrepancies in calibration reported by various experimenters.

Measurements of the unirradiated sphere gap show gradual transition from the voltage which causes breakdown for 10 percent of the applied impulses to that which causes 90 percent breakdown, whereas the breakdown voltage is sharply defined with the gap irradiated. The mean breakdown voltage of the unirradiated gap may be about 13 percent in excess of that for the irradiated gap. With larger gaps, for which a difference between the breakdown voltages for positive and negative impulses is recorded when one sphere is earthed, the difference is largely influenced by irradiation. The mean breakdown voltage for an unirradiated gap of 9 cm. between 12.5-cm. diameter spheres is 20 percent higher than the irradiated value for a positive impulse and 1.5 percent higher for a negative impulse.

It is premature to make final recommendations as to the amount of irradiation required, as present findings need to be confirmed by research workers in other laboratories. The results do indicate that more attention than before must be paid to irradiation and that the attention of users of the sphere gap should be called to possible inaccuracies in the absence of irradiation. Deliberate irradiation from a quartz mercury-arc lamp, as recommended in the A.I.E.E. standard and suggested in the British standard, or insertion of radium in the high-voltage sphere, is deemed essential.

Induction Steel Furnaces

From a paper by Frank T. Chesnut before the Electrochemical Society, Columbia, Ohio, October 12, 1945.

HIGH-FREQUENCY induction furnaces are now considered indispensable to certain branches of the steel industry. Early difficulties have been overcome and the furnace has become a well established unit. A compromise frequency usually is selected which combines the inherent electromagnetic stirring at low frequency (which is proportional to the ampere turns in the furnace inductor) with the high frequency (which gives excellent heating but poor stirring).

For any practical melt above 300 lb., a frequency of 1,000 cycles will serve and has become almost standard for steel making equipments. Frequencies of 3,000 to 12,000 cycles can be used for larger melts, but at a disadvantage. For laboratory and very small-scale melting, frequencies as high as 20,000 to 60,000 cycles, obtained from spark-gap converters, are often used.

Advantages of the high-frequency furnace for alloy steel making include carbon-free melting, the inherent stirring, flexibility, and control of the melt. Oxidation of the elements of the alloy and carbon pickup are at a minimum. If the analysis of the scrap is known, successive melts can be turned out with ease to

exacting specifications and non-routine melts can be made on short notice. High efficiency and comfortable working conditions also are important.

The induction furnace takes the smallest bulk production but the highest-priced steels, such as the top grade tool and alloy steels, high-nickel and high-chromium alloys, magnet steels, and other alloys where the constituents are high priced or where analysis is critical. Metallurgical laboratories in government, educational and business establishments depend on high-frequency furnaces to guide and to increase the production and use of steel.

Treatment of Southern Pine Poles

From a paper by J. A. Vaughan, Research Engineer, Southern Wood Preserving Company, Atlanta, Ga., presented at a meeting of the Transmission and Distribution Committee of the Pennsylvania Electric Association, Reading, Pa., October 18, 1945.

OF THE TWO METHODS long used for treatment of Southern pine poles, the open-cell process employing preservatives insoluble in water, such as creosote, is used almost universally when the timber is to be exposed to the weather. In conditioning poles before treatment three methods are considered:

1. Thorough air seasoning. This has the advantages of developing seasoning checks before treatment, reducing weight and allowing greater gross injection of preservative, while its disadvantages are carrying stocks over undetermined periods, possible fungus infection and incipient decay, and difficulty to season large poles thoroughly.

2. Steam-and-vacuum conditioning of green poles. This avoids seasoning defects and extra handling and assures sound poles, but season checks develop after treatment, there is a lower injection of preservative, and valuable cylinder time is consumed.

3. Air seasoning for 30 to 60 days, followed by steam-and-vacuum conditioning. This is intermediate; it allows development of seasoning checks before treatment, permits adequate injection of preservative, and results in lower weight than with green poles, but it requires extra handling and some extra cylinder time.

Wood cells may contain moisture in the form of water or water vapor which may hold in suspension or otherwise sugars, starches, gums, mineral matter and the like. It has been found that the wood substance of all species has a fairly constant density of about 1.55, variations in specific gravity of different woods as measured depending on the proportion of air space. In the same species, such as Southern pine, individual samples may vary from 0.456 to 0.608.

Air space, percent of moisture, and specific gravity of the wood must bear some relation to the quantity of preservative that may be injected. Another factor is the proportion of untreatable wood. For instance, the heartwood of Southern pine is quite resistant to treatment with oily preservatives.

Reference is made to tables on page 23 of "Manual on Preservative Treatment of Wood by Pressure" by J. D. McLean, which shows the amount of voids and possible absorption of preservative. Computing on the basis of these tables, it is indicated that the gross absorption by average air-seasoned poles would be 17.63 lb. of preservative, while for green timber conditioned by the steam-and-vacuum process an average gross absorption of 12.15 lb. might be expected. Gross absorption is a function of the volume of voids, and does not necessarily represent depth of penetration.

Treatment of crossarms is similar to that for poles, except that kiln-drying often is used. Being of relatively small section they may be treated and allowed to go in service with large amounts of moisture in them, which subsequently will evaporate. There is the danger, however, that these arms will then check and warp. Proper kiln drying will eliminate most of the moisture and will make it possible to discard unsuitable pieces of timber. Development of suitable specifications should result in creosoted pine crossarms of excellent quality that will give good service.

Galvanizing Bath Has Long Life

From an article by H. E. Meuche in "Brown Boveri Review," March, 1945.

SIX YEARS' LIFE of a zinc bath for galvanizing installed in 1938, is reported from Switzerland. This record is attributed to electric heating with automatic temperature control at 450 deg. C. regardless of the quantity of material being galvanized. The coating is said to be more uniform and the quantity of zinc required less than with the previous coal-fired baths. One tank 24½ ft. long with a capacity of 50 tons of molten zinc was in service seven years, and was cut out only because of a leak, whereas the condition of the metal in coal-fired tanks was such that it could not be used more than one or two years. A still larger bath built by Brown Boveri is about 42½ ft. long and has a rating of 340 kw.

Freezeproofing Coal in Shipment

From "Bituminous Coal Research," October-December, 1945.

PRELIMINARY RECOMMENDATIONS for freezeproofing of carload coal shipments, based on last winter's field trials, have been made by Battelle engineers. Both flake calcium chloride and rock salt may be used, but salt protects only to −6 deg. F. The following table indicates the suggested amounts to be used:

Surface moisture, percent.....	3	6	9
Anticipated outdoor temperature, deg. F.	Pounds of calcium chloride or rock salt suggested per ton		
20	3.4	6.8	10.2
10	5.0	10.0	15.0
0	6.6	13.2	19.8
−10*	8.2	16.4	24.6
−20*	9.2	18.4	27.6

* Calcium chloride only.

One-fourth the total amount should be sprinkled by hand on the coal in the hoppers and near the bottom surface of the car; remaining three-fourths is distributed uniformly throughout the coal.

Progress in British Overhead Lines

From a paper by W. J. Nicholls before the Institution of Electrical Engineers, (British), November 14, 1945.

WHILE NO OUTSTANDING changes in the design of steel towers have occurred recently in Great Britain, there has been continual development in high-tension practice. On 132-kv. lines the original conductors, steel-core aluminum cable (ACSR) of 0.175-sq. in. copper equivalent, consisting of 30 aluminum and 7 steel strands, has proved generally satisfactory. Vibration occurred with a working tension of 8,000 lb. at 22 deg. F. with ice and wind, equivalent to 3,450 lb. in still air at 40 deg. F. When broken strands were discovered Stockbridge dampers were installed, one for each normal span and two where the span exceeded 1,000 ft. or where vibration was excessive. New lines were erected with a tension of 2,560 lb. at 40 deg. F. and the use of dampers was continued.

Little corrosion has occurred, mostly in limited industrial areas, where the aluminum has blackened and pitted. The life in these cases, which often are confined to two or three spans, can be taken as seven years. Near the south coast salt deposits on the conductor penetrate between the outer strands and cause bulging, brittleness and broken strands. Here the life can be taken as ten years.

Mid-span cone-type joints of three types

installed prior to 1938 have not been satisfactory on ACSR, the cables breaking some 12 to 18 in. from the end of the joint. Compression joints have been substituted.

Since 1938 double ground wires have been erected for one mile at the end of each line to protect substation apparatus against lightning. The two ground wires are placed above and outside the top conductors. Ground rings at the live end of the string with horns at the ground end have proved of insignificant value, and present practice is to fit horns at each end of each string. Arcing gaps between fittings at the ends of the string have been graded, 39 in. for the first mile and 44 in. beyond, and at all railroad crossings 48 in.

Arc Furnace for Steel Making

From a paper by Conrad Wissman before the Electrochemical Society, Columbus, Ohio, October 12, 1945.

MELTING OF STEEL in the three-phase electric arc furnace has marked advantages. The principal one is that no impurities such as oxygen and sulphur are introduced in the process, and uniform composition of the product is assured. The acid electric furnace is commonly used for foundry steels, as the metal can be poured very hot without undue damage to the furnace lining.

Less silicon and manganese are required to obtain the same analysis than with flame heating, as a good portion of these additions is made to reduce ferric oxide contained in the melt. In making high-alloy steels such as stainless and high-speed this is very important, and it is one of the main reasons why electric furnaces are used so extensively for the purpose despite the higher cost.

Electrical Hay in Switzerland

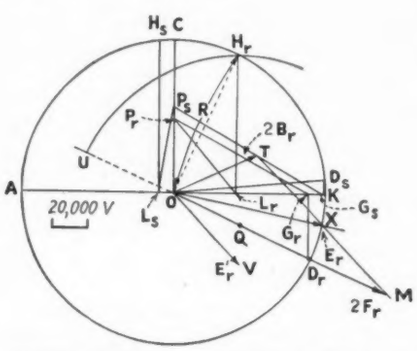
From an article in "Brown Boveri Review," March, 1945.

DEHYDRATED GRASS produced as a concentrated substitute for ordinary hay has received considerable attention in Switzerland. The principle of the heat pump is employed in a process developed at the Swiss Federal Institute of Technology. Air is compressed by a rotary compressor, passed to the drying room, and after becoming saturated with water is expanded in a turbine coupled to the compressor. The water is removed by a separator and the dried air is again run through the compressor, forming a closed cycle. An electric motor furnishes the deficiency of power, which is about a third of that required by the compressor.

Solving Transmission Line Problems

From the abstract of a paper by R. H. Paul in the "Journal of the Institution of Electrical Engineers" (British), September, 1945.

FORMULAS FOR FINDING the voltage E and the current I at any point on a transmission line in terms of the voltage E_r and current I_r at the receiving end involve the hyperbolic sine and cosine of the complex angle $x\sqrt{zy}$, where x is the distance from the receiving end, z the impedance per unit length and y the admittance per unit length. The computation involves use of charts and tables of hyperbolic functions of complex angles or their expansion in convergent series. Two methods of avoiding these are presented.



CONSTRUCTION for graphical solution of transmission line

In one method, putting $E' = I\sqrt{z/y}$ and $\sqrt{zy} = \alpha - j\beta$, it is shown that $E = F + B$ and $E' = F - B$, in which F and B are two new terms called respectively the forward and backward wave vectors. Proceeding from the sending end to the receiving end the amplitude of F decreases in geometrical progression by e^{α} per unit length and its phase angle in arithmetical progression by β radians per unit length. The amplitude and phase angle of B increase in a similar way as those of F decrease. At the receiving end $F_r = \frac{1}{2}(E_r + E_r')$ and $B_r = \frac{1}{2}(E_r - E_r')$. Thus F and B can be calculated for any point and from them E, E' and I can be found.

In the second method F_r and B_r are expressed in the form $F_r e^{j\theta_1}$ and $B_r e^{j\theta_2}$ respectively. By putting $R = 2\sqrt{F_r B_r}$, $e^{\lambda} = \sqrt{F_r/B_r}$ and $\mu = \frac{1}{2}(\theta_1 - \theta_2)$, and rotating the vector of reference positively by $\frac{1}{2}(\theta_1 + \theta_2)$ E can be expressed in the form

$E = R \cosh [(\lambda + j\mu) + (\alpha + j\beta)x] = R \cosh (p + jq)$, say.

Similarly $E' = R \sinh (p + jq)$. The amplitude of $\cosh (p + jq)$ is $\sqrt{(\sinh^2 p + \cos^2 q)}$ and that of $\sinh (p + jq)$ is $\sqrt{(\sinh^2 p + \sin^2 q)}$. The phase angle by which the former leads the latter is $\arctan\left(-\frac{\sin 2q}{\sinh 2p}\right)$. In this expression p and q are real quantities for which tables listing small differences are available.

A graphical solution by the second method also is disclosed. In the diagram OX and OV represent E_r and E_r', respectively, in magnitude and phase; OM is $2F_r$ and OT is $2B_r$. R, the geometric mean of OM and OT, is obtained by a geometrical construction, and a circle is drawn with center O and radius R to intersect OM in D_r. OK bisects the angle MOT so that the angle KOM $= \mu$ (in this example negative). OC is perpendicular to OK and OH_r to OD_r. On OC, OP_r is taken equal to $R \sinh \lambda_r$, this length being found incidentally in the geometrical construction. D_r and H_r are projected to G_r and L_r on OC, so that $OG_r = R \cos \mu$ and $OL_r = R \sin \mu$. The lengths P_rG_r and P_rL_r represent E_r and E_r' in magnitude. To find the voltage and current at the sending end OP_r is increased to OP_s, where OP_s is $R \sinh (\lambda + \alpha l)$, l being the length of the line, and OD_r and OH_r are rotated positively by βl to new positions OD_s and OH_s. P_sG_s and P_sL_s give E_s and E_s' for the sending end.

Remedies for Graphitizing of Pipe

From a paper by Dr. S. L. Hoyt before the American Society of Mechanical Engineers, November 29, 1945.

PREVENTION of graphitization of pipe in power plant steam lines appears to be possible through the use of low-aluminum or silicon-killed carbon-molybdenum steels with initial graphite content of not more than 0.01 percent, or chromium-molybdenum steels containing 0.50 to 1.00 percent chromium and 0.50 percent molybdenum.

Stress relieving of pipe joints after welding, and the replacement of severely graphitized pipe in service also was suggested. Though joints exhibiting some graphitization in service generally can be remedied by normalizing at 1,650 to 1,700 deg. F., they should be checked periodically. When a joint is severely graphitized the only safe procedure is to cut it out and reweld, or replace it with a spool

of new pipe. In fact, where graphitization in a large number of pipes throughout the installation is severe it is safest to replace all the pipe with a type resistant to this trouble.

The deoxidation process in making steels which presumably are prone to graphitization has a pronounced effect. In particular the use of from 1½ to 2 lb. of aluminum per ton of steel is sufficient to promote it in carbon or carbon-molybdenum steels. Steels deoxidized with not more than ½ lb. of aluminum per ton, or straight silicon-killed steel, were found relatively immune to the trouble. Tests have shown that the non-graphitizing steels have not more than 0.01 percent free carbon and the graphitizing steels about 0.04 percent. Manganese and silicon are known to have an effect, but up to the present it has not been determined. Molybdenum and particularly chromium tend to keep the steel from graphitizing.

The heat effects of welding establish a highly critical zone. This is the major, though not the only, cause of segregated graphite in steam lines. Stress relieving at temperatures high enough to eradicate the structure of the heat-affected zone have an important effect on elimination of segregated graphite, but this treatment must be looked on as corrective for use with a known or suspected piece of steel and not as a substitute for a stable steel.

The research on which the findings were based was carried out at Battelle Memorial Institute under auspices of the Edison Electric Institute and the Association of Edison Illuminating Companies.

Electric Arc-Welding Standards

From a statement by National Electrical Manufacturers Association, December, 1945.

REVISED STANDARDS for electric arc welding machines and electrodes, Publication No. 45-105, September, 1945, have been released by NEMA. The new standards coordinate and simplify the method of rating welders. Heretofore d.c. welders were rated on a 1-hour and ½-hour basis, and a.c. welders were rated on a duty-cycle basis, each with a maximum and a minimum welding current. The new standard rates both on the basis of the same duty cycles, and in addition a definite duty cycle has been assigned to the maximum output.

Welders corresponding to the old 1-hour d.c. and 50 percent duty cycle a.c. welders are now rated on a 60 percent duty cycle and must deliver 125 percent rated load at a 35 percent duty cycle. Sizes of 200 amp. and less, previously rated ½-hour 30-volt d.c. and 40 percent duty cycle a.c., are now rated at 50 percent duty cycle and must deliver 125 percent rated load at a 30 percent duty cycle.

A new standard is introduced for transformer arc welders of less than 200 amp. served by limited-capacity power lines supplying farms or small communities. These welders are rated at a maximum output at 20 percent duty cycle at a load voltage which gives satisfactory welding. Input is limited so the power companies may know the maximum conditions.

A section of definitions of welding terms includes many revisions, and there is an appendix containing an excerpt from the ASA test code for transformers.

Electrode standards also have been revised, including classifications, standard diameters and lengths and package weights. A new standard for identifying color markings for electrodes is contained in a separate publication, No. 45-108.

Deformation of Turbo-Generator Windings Studied

From a paper by R. H. Coates and B. C. Pyle before the Institution of Electrical Engineers (British).

FAILURE OF large turbo-alternator rotors as a result of copper distortion has become a major cause of outages in England since power demand has been so great that instead of furnishing the base load and remaining in service continuously the alternators are started and shut down daily and run at full load for many hours.

Examination of defective rotors of 30-mva., 3,000-rpm. machines indicated that shortening of the copper had caused double grounds in three different ways. In the simplest the corners of the end turns of the rotor windings, not being rigidly packed, became distorted owing to shortening of the portion of the winding in the slot, the corners of the end turns in consequence pulling into contact with the core. In two other cases copper shortening occurred after mechanical failure of the supporting structure which held the end turns axially away from the poles. In still another instance, under the influence of repeated heating and cooling the winding was forced outward in the slots toward the periphery, leaving the coil unsupported with a gap between the copper and the bottom of the slot. The compressive stress, when subjected to speed and high temperature, proved sufficient to buckle the bottom turns, sometimes in several places. This buckling increased with each heating cycle until sharp edges of the copper were forced through the slot insulation, causing grounds. Measurements indicated that the copper cross section had increased by as much as 3 percent.

Elaborate arrangements were made to measure temperatures of the coils. The maximum operating cycle was from a start at 34 deg. C. to 130 deg. C. at full load; the average temperature range was about 80 deg. C. Extensometer tests combined with the temperature tests showed that the theoretical stress-strain relation did not agree with the measurements, which led to detailed consideration of the properties of copper. Annealed copper stressed to 20,000 psi. has a deformation of about 6.1 percent, while cold-worked copper deforms only 0.1 percent. There also is "creep" and finally "relaxation" or plastic flow when the metal is kept under strain for an extended period. The shortening of the coils was the result.

The principal remedy adopted was to shut down the machines with as little loss of heat as possible and to preheat the field coils with direct current before starting up, thus holding the temperature to as small a range as practicable. The rotor temperature limit has been set at 135 deg. C. pending further investigation.

Unusual Overspeed Test

From an article by F. O. Weber in "Brown Boveri Review," December, 1944.

OVERSPEED TESTING of the 20-pole field rotor of a single-phase 25,000-kva. alternator was carried out some time ago in the Brown Boveri factory. The 225-ton rotor, with an outside diameter of 7 m. (275 in.), is designed for 100 rpm. In the test the speed was increased gradually to 280 rpm. Motor power of 1,600 kw. was required to accelerate the rotor to that speed in 20 minutes, after which it was held at top speed for 2 minutes. To reduce windage, wood shuttering was attached to the rotor, so that only 400 kw. was needed to maintain the speed, whereas almost 3,000 kw. would have been needed otherwise. At top speed each 3.5-ton pole was subjected to a centrifugal force of approximately 1,000 tons. Static bearing friction was reduced by forcing oil under the journal bearings at a pressure of 100 kg. per sq.cm. (1,420 psi.).

At top speed, stresses in the metal were eight times normal, but it was not strained to more than two-thirds of the yield point, so a large factor of safety remained. The specifications were abnormally severe as the customer was not willing to risk danger from a runaway waterwheel.

Editorials

S. B. WILLIAMS, *Editor*

Legislation to Prevent Utility Work Stoppages

A BILL to outlaw utility work stoppages has been introduced in the New Jersey legislature with the backing of the governor. If passed, it would place New Jersey as the first state to have a fact-finding plus seizure procedure for preventing utility service shutdowns as the result of strikes.

Whether this bill is approved or not, the mere fact that it has been introduced as an administrative bill is strong evidence that the public is conscious of the need for some means to prevent utility service shutdowns. The people of a large part of the state have had an opportunity very recently to consider what their plight would be if a utility strike actually took place. Fortunately, collective bargaining won out, but the fear of the threat will remain in the minds of people for a long time.

It has been our thinking all along that some way must be found to prevent loss of utility service to the public. Obviously, collective bargaining is the most desirable means, but when that fails some less desirable but effective way to keep labor at work is demanded by the public. By no stretch of the imagination would the public be willing to be deprived of light, water, transportation and other essential services.

The unfortunate thing about legislation, or any other governmental interference in such negotiations, is that it weakens free bargaining. On the other hand, if legislation is carefully drawn to exclude any regimentation for settling differences it might act to stimulate collective bargaining.

For one thing, the public which pays the bill and will be most affected by a strike is entitled to know the facts. Since utility services are regulated by most states as to rates and earnings, the time may come soon, if it is not already here, when the ability to pay will be an important factor, when state commissions may have to state what relief they will give companies that are required to pay heavy wage increases.

Likewise, the public is entitled to know if it is to be inconvenienced because of union organization problems or jurisdictional disputes—differences on which management can do virtually nothing. It is entitled to know whether a strike looms because labor is interfering with management's right to make operating decisions, such as the sale of its generating stations, or contracting of line construction, or bi-monthly meter reading.

On the other hand, fact finding can result in the regimentation of compulsory arbitration if it is accompanied with the power to recommend or to adjust. It should be enough for the facts to be made known. If after that a settlement cannot be reached through negotiation, it is time for the public to take a hand through state operation until such time as the differences can be composed.

When so many people are affected in so many important ways, it must not be possible for any group of men, not elected by the public for that purpose, or for any company, to say that the public will or will not be made to suffer the inconveniences and hardships and losses attendant upon a stoppage of utility services. That, it seems to us, is important and any legislation, regardless of what else it may accomplish, must have that as its primary purpose.

Industry Trade Association Once More Representative

WITH THE RETURN of Consolidated Edison to the Edison Electric Institute's fold the first of the year, the industry once more has a trade association that can be said to be representative. E.E.I. now has approximately 200 member companies, the combined generating capacity of which is between 75 and 80 percent of the capacity of all the privately owned electric utilities of United States.

At the bottom of the depression the membership had dropped to a low of 145, but since that time there has been a steady increase except for a short period when fears of SEC regulations brought about the resignation of several large systems. With one exception, they are now all back so that at the present time there are only two large systems that are not in E.E.I.

The electric utility industry needs a strong trade association to do an operating job entirely apart from that of waging the battle of private versus public ownership, now being undertaken from Washington by another and independent association. Conceived at the time of the change from the old NELA as a fact-finding or statistical organization, the Institute has gradually broadened its interpretation of statistics until it is now able to enter the post-war period with programs for more services to the members that should help not only in the daily operations but also in the marketing of electric service. Since the first of the year a new industrial relations department has started, making the first time that the industry has taken collective interest nationally in this subject. Also, a new rural department to stimulate development of farm usage has just started, while a sales training program that can be used by all members of the electrical industry is now getting into use. It is our impression that this is but the beginning of a renascent Institute.

Certainly it is good once more to see an industry united in work for the good of all.

Mineral Powder Insulation

MANY CONDUCTOR INSULATION PROBLEMS would prove easier of solution if natural inorganic materials as a group should lend themselves to moulding as readily as the plastics and tapes can be conformed to the conductors. Use has been made, of course, of compressed powders in heating elements but these are commonly employed in fixed position and not flexed as circuit conductors usually have to be.

The British have been exploring this matter and find several promising minerals and processes for depositing such materials as pulverous oxides of magnesium or aluminum around a conductor within a copper sheath. Not only is heat conductivity better but so is the breakdown strength (per centimeter) when the material is compressed to, say, 3 tons per square inch. Compression also impedes the entrance of any free moisture which might reduce breakdown value and allow leakage current to flow.

Because these natural oxides are inherently fireproof and chemically stable and are not injured physically by bending deformation, although they may redispose so as to be less effective, they will, as a rule, withstand high temperatures and be resistant to changes due to exposure to air or to soil waters. If they tend to attack copper under certain conditions, the surface of the metal can be inhibited to such action.

Wherever, then, the present inorganic insulations (including the recent silicones) do not lend themselves to adaptation as conductor insulation for high temperature or other exposure duty, there appears to be sufficient reason to believe other materials in compressed powder form can perform satisfactorily, at least for low voltage work, to warrant investigation. One place worthy of consideration is buried cable and another is cable exposed to boiler room or comparable temperatures. Applications to aircraft, oil tankers and furnace doors are already under study abroad, from which information of interest to the electrical industry may be derived.

Super Cooperatives in the Utility Business

THE ELECTRIC UTILITY BUSINESS isn't by any stretch of the imagination agriculture and for that reason a group of rural electric cooperatives cannot band together to enter the utility business and incorporate as a cooperative. Such in essence was the decision of the Missouri Supreme Court in ousting the Sho-Me Power Cooperative from ownership and operation of the Missouri Electric Power Co. system which, with the aid of loans from REA, it had purchased nearly three years ago.

This particular case has aroused considerable attention because it was the first instance of a group of cooperatives forming a super cooperative to purchase an entire utility system of considerable size. There have been other cases of cooperatives banding together for mutual benefit through joint ownership of transmission or generating facilities but here is an instance where little or no mutual assistance can be shown, for, as the court stated, only four out of the original twenty-six incorporators operated in the territory served by Missouri Electric Power. This was an out-and-out bid to get into the utility business.

Since the court granted Sho-Me a year in which to reorganize, it will be some time before this matter can be finally settled and in the meantime the government through REA has invested some four millions in the utility business in that section of Missouri. The question has been asked whether Sho-Me would form another company that legally could hold and operate the properties or sell out to nearby private utilities. Nobody knows or is willing to venture a guess, but it seems clear that any incorporation must be other than as a cooperative. If that is so, then, by whatever name it is known, the resulting corporation is a private utility which, regardless of financing, must obey all the regulations governing private utility business.

Hunches Make Poor Trouble Shooters

FINDING OUT quickly and surely just where a fault occurs is a big factor in holding a good record for brevity of outages. Some distribution departments, here and there, have a maintenance man with an uncanny intuition that, despite a minimum of immediate information, tells him almost unfailingly just where to go to remedy the trouble. There are too few troublemen that good, however, to permit having a company program founded on so tenuous a reliance. But it is even more precarious to depend on men who play hunches when it comes to spotting the place where things have gone wrong. A hunch is just an inspired guess with the weakness that the temptation too often is to go back to the spot where trouble occurred on the immediately previous occasion, which is just as likely to waste precious time as to save it.

Sectionalization and automatic restoration are the ideal objectives, short of building a fault-proof system. When the lockout occurs there is still considerable dependence on human agencies to interpret the information obtained from customer complaints, meter indications, telltales and even the good guesses, to decide where to go to eliminate the disturbances and repair the facilties.

Therefore, the utility intent on attaining and holding a good record of service continuity will contrive a trouble-elimination procedure which correlates all the automatic information and all the possibilties of the test apparatus and the fault-indicators with the skill of its men insofar as they have acquired a quick and infallible sense. After that job of all-round formulation of procedure has been well done the thing to do is to stick to the procedure and not let more hunches vitiate the result.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Ickes Put in Power Trust by Liberals

STUDY of the 13-year-old upsurge of public ownership in the electric power field leaves the impression that the late President Roosevelt was probably the greatest friend of public power during the era, particularly from the point of view of influence and conviction.

Perhaps the next greatest friend of public power, particularly from the standpoint of day-to-day fighting for it, scheming for it, planning new ways of extending its scope, influence and territory, is Harold Ickes, who has been Secretary of the Interior for 13 years next month.

Attack by Young Liberals

Thus it comes with a shock, if nothing more, to see the self-styled curmudgeon attacked—with a vigor and vehemence that is customarily reserved for Mel Ott by the patrons of Ebbetts Field—by serious young liberals who would probably concede, if their arms were twisted, that they and they alone have The Word on public power.

The National Farmer's Union, for instance, has been insisting for weeks that Ickes has joined the power trust because he has been, and still is, opposing more valley authorities of the TVA pattern—independent and uncontrolled by Washington. The Farmers Union is that organization which last winter was unable to swing the confirmation of its own man, Aubrey Williams, for administrator of the Rural Electrification Administration. (This may have been fortunate since Williams was so intimate with the electric power industry that he asserted that alleged utility opposition to him was led by "Tate, of Georgia Power." Tate, it seems clear, was Steve Tate, Georgia resident and one-time head of the National Rural Electric Cooperative Association, which is not a private power organization.)

More recently, Ickes was the subject of a patronizingly bitter article in Sen. Robert M. LaFollette's *Progressive* entitled "Harold Ickes—Bureaucratic Kleptomaniac." Its author, Richard L. Neuberger, confided that he once was strong for Harold, but that these days, with the Ickes' coat speckled with the dandruff of Wall Street, "One wonders whether the name of Harold Ickes can be added to this class" of liberals who "outlive their usefulness."

The biggest thing Neuberger and the National Farmer's Union seem to have against Ickes is that he fought—and ever so successfully—both a Missouri Valley Authority and a Columbia Valley Authority as independent as TVA. Ickes, who at the very least has been one of the two most effective men in public power throughout public power's greatest era, is now a knave because he is against a legislative proposal which many people will insist never had any more chance of passage than it had of defeat.

Private Power Not to Blame

It will perhaps be a relief to the private power industry to learn that it no longer can be blamed for killing MVA—if MVA be dead. Heretofore, the chant has been that the Murray Bill would have been law in three weeks after it was introduced but for the machinations of the power trust. Now one learns that Ickes did it, a discovery which makes a good deal more sense than the earlier proposition when the legislative score run up by Ickes during the past twelve years is compared with that of the power business.

Inasmuch as it seems still to require more to join the power trust than the endorsement of the *Progressive* and the National Farmer's Union it might be noted in passing that the power trust will doubtless require of Mr. Ickes that, as a token of good faith, he cancel out his achievements in the Northwest, his prospects in the Southwest, and his jurisdiction over sales of federal energy everywhere but in the TVA region. Should he prove willing to do this, the *Progressive* and the National Farmer's Union will have a case and the private power business will have a competitive situation approximating the status quo ante Roosevelt—and Ickes.

While Ickes goes on flunking out of the select school of liberals, his boss, President Truman, comes closer and closer to doing the same, for according to people who will tell you that they know, Mr. Truman no longer is particularly strong for independent valley authorities.

These sources point in particular to a letter written by Mr. Truman to Ora Bundy, president of the National Reclamation Association, during NRA's annual convention at Denver last fall. They insist that it represents a retreat from President Truman's earlier inexplicit but none-the-less apparent position in favor of TVA-type authorities.

Truman in Same Boat

The pro-TVA-type-authority liberals are not the only ones who believe that Mr. Truman is cooling off on independent authorities. Some people whose principal interest in Washington is Reclamation insist that such is the case. In support of their point, they offer incidents which they ask to be held in confidence, but which, if credible, are convincing.

Disregarding the self-serving gossip and the material which can be spoken but not printed, there are two actualities which indicate that Mr. Truman, regardless of his personal convictions, is now unwilling as a political leader to go down the line for independent valley authorities.

First is the present status of the Murray MVA bill. Its sponsor recently asked the one committee of three in which his bill stood any show at all of a favorable report, to postpone hearings indefinitely.

The second is the tenor of Mr. Truman's recent budget and state-of-the-union message. Therein, the President could muster no stronger endorsement of independent authorities than his statement that "We shall continue our plans for development of the Missouri Valley, the Arkansas Valley and the Central Valley of California."

Our plans for these valleys, be it noted, are not for TVA-type authorities.

NEWS OF THE WEEK

Distribution Construction Not Yet Halted by Strike

Survey of 50 Operating Companies in All Sections of Nation Shows That Most Have Sufficient Inventory to Carry On Despite Strike at Electrical Manufacturing Plants—Lack of Steel and Copper a Threat

The electrical manufacturing strike has neither halted construction of distribution lines nor yet curtailed appreciably the distribution construction programs on which electric utilities had been able to embark, a survey by ELECTRICAL WORLD showed this week.

Of 50 companies surveyed, none reported that its distribution construction program had been halted and only a few reported theirs had been curtailed for want of material.

Most of them indicated, however, that the programs they are carrying on despite the strike are far from what they could and would engage in if materials and manpower were available in sufficient volume.

Many of the companies, in addition, indicated that further distribution construction would come to a halt in periods ranging from two weeks to two months if the steel and electrical manufacturing strikes remain unsettled. A few fortunate companies reported they could proceed on schedule for as long as six months, and one figures on completing everything which must be finished by fall.

Tabulation of answers to five questions posed by ELECTRICAL WORLD showed that 10 companies regard their distribution inventory as "good," while 15 regard theirs as only "fair." Thirteen called their distribution inventories "poor," and 11 described them as "spotty." One failed to answer this question.

Most of the companies declined to specify the length of time they would require to get back into construction at a pre-strike rate after electrical manufacturing resumes at a pre-strike rate. This, they indicated, depends on the duration of the electrical strike and the steel strike as well. Five companies, however, felt they could get back in operation, assuming the strike goes on long enough to halt or seriously curtail their programs, in one to four weeks; eight indicated that they would need five to eight weeks, and eight more figured they would need nine weeks or more.

Questioned as to whether they saw any prospect of being unable to connect housing projects for want of materials, 17 replied in the affirmative, although many of these tied their answers to a continuation of the manufacturing or steel strikes. Twenty-two companies were not worried over such a prospect, and nine had no answers, most of them indicating that no housing projects are under way or contemplated in their territories. Two companies were on the fence, undecided as to whether any real prospect of trouble exists.

As was the case with the replies on the state of distribution inventory, the answering companies split rather evenly their answers to a question on their general inventory position. Twelve companies felt their general inventory position good, while 15 called theirs fair. Thirteen considered theirs poor, and eight described theirs as spotty. Two had no answers.

Inasmuch as the survey was aimed principally at determining what effect the manufacturing strike has had on distribution construction and inventory, stocks of wood poles were not considered in the same light as items made in strike-bound plants. Probably the most general complaint wath regard to construction or inventory difficulties, however, was of the shortage of wood poles and cross arms. Oddly enough, a small handful of the 50 systems asserted that they were having no trouble at all with poles.

No attempt was made to survey Rural Electrification Administration cooperatives, but a check by REA of its field engineers, who are described as being in close touch with the co-ops, brought the information that the strike had not effected any change in delivery situation early this week, that no projects had been halted, and that the whole REA program was going very slowly when compared with what could and would be done if materials and manpower were readily available. REA reported only a small pickup in deliveries of conductor, pole anchors, transformers and such distribution equipment even after V-J Day brought war contract cancellations in real earnest.

Will Save for Emergencies

Many of the companies which replied went out of their way to indicate that they will halt or curtail construction quickly when it becomes necessary to do so to keep adequate emergency stocks on hand. All electric companies were urged to do this recently by Paul B. Valle, formerly Administrator of WPB's order U-1 and now handling utility problems for the Civilian Production Administration.

However much longer the electrical manufacturing and steel strikes go on, some CPA officials expect one of the wartime trouble makers—copper—to continue as a shortage item in the reconversion program. They predict that the country will have either to resume imports which were cut drastically after the military needs dropped, or dig into the national stockpile.

Meanwhile, copper miners and smelters

Section	Systems	QUESTION No. 1		QUESTION No. 2				QUESTION No. 3				QUESTION No. 4			QUESTION No. 5			
		Yes	No.	Good	Fair	Poor	Spotty	Weeks 0–4	Weeks 5–8	Weeks 9 Up	No Ans.	Yes	No	No Ans.	Good	Fair	Poor	Spotty
New England	5		5		3	2		1	1	3		3	2				3	2
Middle Atlantic	11		11	5	4	1	1	2	1		8		9	2	7	2	1	
Southeast	6		6		1	1	4		1		5	3	1	2		2	1	3
Central	18		18	4	4	5	4	1	5	5	7	7	7	4	3	7	5	2
Southwest	3		3	1	1		1	1			2	2		1	1	1		1
Mountain & Pacific	7		7		2	4	1				7	2	3	2	1	3	3	
TOTAL	50		50	10	15	13	11	5	8	8	29	17	22	11	12	15	13	8

SURVEY QUESTIONS—1. Has the manufacturers' strike curtailed your deliveries to the point where you have had to halt new construction to save available distribution materials for emergencies? 2. What is your company's inventory position with respect to distribution materials, good? fair? poor? very bad? 3. How long will it take after the strike is settled before you will be able to resume new distribution construction at a rate comparable to that carried on before the strike? 4. Is there any prospect that you will be unable to connect new housing projects in your territory for want of materials? 5. What is your general inventory position regarding materials affected by the strike?

in Utah remained on strike early this week, although the walkout had not then spread to neighboring copper states of Arizona and Nevada. Half the rod mills were down with labor trouble, tying up half the copper wire capacity. It was pointed out that if the strike further halts or curtails the production of copper, it won't make a great deal of difference whether the manufacturers' strike is settled or not, since copper is the heart of the industry.

"If the steel strike is settled, making available silicon steel for transformer cores," one CPA man declared, "and if the manufacturing strike is settled so there are people to manufacture transformers, the problem will then have resolved itself to one of obtaining the copper wire for winding the cores."

The lead shortage continues, maintaining its implications for users of underground cable, but this is not regarded anywhere near so seriously as the copper situation.

An indication of the small incidents which have broad effects is seen in the story of the stranding machines on which ACSR conductor is made. The story is that these machines were put almost completely on war work during the period of heavy military orders, their output devoted to filling the Army's needs for wire rope. Now the machines are available again for civilian production, but they are badly worn, incapable of their former output. Replacements are difficult to get. Even before the strike, in addition, steel stranding was scarce.

"Inventory satisfactory for normal operations and maintenance but not sufficient for planned capital reinforcement," declared the purchasing agent of one Middle Atlantic states company. His comment was indicative of the sentiments indicated by a number of systems which replied.

SPA Has Equipment But It's Hard to Buy

The Reconstruction Finance Corporation, which is disposal agency for capital goods and equipment held by the Surplus Property Administration, has a certain amount of equipment which electric utilities could use to bolster their construction programs, but RFC men concede the manufacturing strike will have been history for some time before a company starting now could obtain any of this equipment.

RFC is not a marketing agency but a great big bank. Most of its people are bankers, not salesmen. Being a government agency in addition to a bank, the red tape arises from two sources. Action can be had only at the top, RFC men say, with consequent delay for numerous signatures.

When all signatures have been obtained and other details completed, RFC is not then in a position to ship the goods. It notifies the Army, Navy, War Assets Corporation, or whatever other agency originally procured the material to ship it, after finding it in a warehouse which may be overstocked. Often the holder is affected by a manpower shortage which precludes prompt action on RFC shipping orders.

For those interested in RFC surplus stocks, these are presently listed holdings, although RFC warns that the data was compiled as of November 30, and thus is not particularly up-to-date:

Weatherproof wire—RFC has $500,000 inventory, in good and bad shape and in varying lengths. The stocks are well split up between various RFC field offices, with not a great deal in any one section.

Rubber insulated wire—$6,000,000 of this material is on hand, of which $5,000,000 is Navy wire, not approved by underwriters, but described as "gold-plated" just the same.

Electrical porcelain—On hand November 30 was $1,407,000 worth of this equipment. There also was $347,000 worth of glass insulators, many of them for telephone lines. Large quantities have been sold for telephone construction since the listing was entered two months ago.

Generator sets—RFC has many of these, $16,000,000 worth, new and used, of all sizes and descriptions.

Motors—These are plentiful, too, but not in standard sizes. Altogether, RFC has $2,160,000 worth. Standard size motors are snapped quickly.

Switchgear—All sizes, big and little, are included in RFC's $1,410,000 stockpile.

Transformers—This lot, valued at $1,487,000, includes everything from instrument transformers on up, old, new, good and bad.

Transmission and distribution equipment—RFC has $1,757,000 worth of it, including pole line hardware valued at $1,477,000. Largest stocks of the latter are handled by RFC's Chicago, New York, Philadelphia, and St. Louis offices.

Wiring devices—These are plentiful and in great variety, although well split up between field offices. RFC has $991,000 worth of junction and outlet boxes alone, $1,075,000 worth of switches and fuse cutouts, and $1,475,000 worth of miscellaneous wiring devices.

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Named to Arizona Board

Yale McFate, Prescott attorney, has been appointed to the Arizona Corporation Commission to complete the unexpired term of William Petersen.

High Court Upholds FCC in N. Y. Telephone Co. Case

Reverses Ruling of District Court for Southern New York Permanently Enjoining FCC Order for $4,166,510 Write-Off—Decision Bolsters Original Cost Theory of Accounting Espoused by Federal Power Commission

The Supreme Court ruled, in effect, this week that there can be no true investment but only a "fictitious or paper increment" out of any profit resulting from a transaction between affiliates.

It took this position in reversing a ruling of the District Court for Southern New York, which had permanently enjoined an order of the Federal Communications Commission directing the New York Telephone Co. to write off $4,166,510. The sum represented the difference between original cost depreciated and recorded book cost of facilities bought by New York Telephone from its parent, American Telephone & Telegraph Co. New York Telephone had argued that since the accounting practices used when the transaction was made had been approved by the Interstate Commerce Commission, then regulating interstate communications, FCC could not retroactively order the write-off. The district court agreed but was reversed this week by the Supreme Court.

Chief Justice Stone Dissents

The reversal wiped out a minor blemish on the wholehearted judicial acceptance of the original cost theory of utility accounting which FCC and the Federal Power Commission have espoused. It was another split decision, 5 to 1, wherein Chief Justice Stone took the position that the judgment should have been affirmed. Justices Black, Reed, and Jackson took no part in consideration of the case.

The sum ordered disposed of arose out of transactions between New York Telephone and A.T.&T. when the latter removed itself from the intra-state telephone business in the mid-1920's. Some years after the transaction had been completed, FCC instituted the uniform system of accounts for companies under its jurisdiction and, after examining the records of New York, ordered the write-off, which the Southern New York District Court enjoined, holding in part that it failed to abide by a stipulation entered by the U. S., in a case between the United States and A.T.&T. The stipulation agreed that where true value could be shown to exist behind investments ordered classified in account 100.4, such amounts may be retained in the account and provision be made for their amortization.

Mr. Justice Rutledge disposed of New York's contention that the write-off could be enforced because the accounting which brought it about was legal when the transaction took place with the assertion that illegality of such accounting was not the basis for FCC's order. The Commission, he said, "went on the view that the inflation was not justifiable in the light of its own original cost system of accounts . . . The principal foundation of the FCC's order was that appellee was legally subject to the requirement of restating its accounts on the basis of original cost, and consequently any excess on its books over American's net book cost must be eliminated."

New York's further argument, that under the uniform system of accounts FCC can reclassify its balances but not direct their elimination, Justice Rutledge said "would be to render the Commission powerless to write off much of the inflation caused by the original accounting in this case." In passing on New York's action in applying a standard "group method" depreciation rate to the used equipment it bought from A.T.&T., the decision added—

"Moreover, it would seem clear that rates established under the group method of depreciation are not properly applied to property purchased which is known not to have as long an expected serviceable life as property of the same sort purchased when new."

The decision disagreed with a New York contention that "so much of the order as affects property already retired is improper, because the sole purpose of original cost accounting is to show separately the amount by which the price paid by the accounting company for property now in service exceeded the original cost of that property."

"The purposes of an original cost system of accounting are broader," Justice Rutledge argued. "Under such a system, the inflation in accounts not only may be segregated but may also be written off."

District Court Erred

Regarding the "final question of whether the order falls within the decision in A.T&T. vs. U.S.," the decision asserted that the district court "misconceived the stipulation's purport and effect" when it held the FCC write-off order erroneous "in the absence of proof that the excess of price over the seller's net book cost was not a "true increment of value." It added—

"When the Federal Communications Commission finds, after full hearing and on evidence which sustains the finding, that part of the cost on the books of a company is due to a profit made by an affiliate or a parent at the time when the affiliate or parent has transferred property to it, the Commission has determined 'after a fair consideration of all the circumstances' in full compliance with the stipulation's reservation that there has been no true investment but only a 'fictitious or paper increment within the meaning of the A.T.&T. company case.'

"We repeat," the decision closed, "that for a court to upset an accounting order it must be so entirely at odds with fundamental principles of correct accounting . . . as to be the expression of a whim rather than exercise of judgment. The order in this case is not of that character."

Chief Justice Stone urged that the judgment of the district court be affirmed rather than reversed by differing directly with the majority's finding regarding the nature of profits between affiliates, saying—

"Before the Commission could rightly direct that the assets in that account, which have not been retired, be written off, the stipulation required it to find

HOOVER MEDALIST—Maj. Gen. W. H. Harrison, left, vice-president in charge of operation and engineering, American Telephone & Telegraph Co., receives the 1945 Hoover Medal from Stephen F. Voorhees, Walker, Foley & Smith, New York. Presentation was made January 23, at joint meeting of A.I.E.E. and Institute of Radio Engineers

after a 'fair consideration of all the circumstances,' that the difference between the original cost and the price claimed to have been paid is not 'a true increment of value.' This the Commission has not done. In the face of its stipulation it may not assume, without a finding based upon evidence, that there is no 'true increment of value' to the assets which respondent purchased over the cost to the seller, merely because respondent purchased the assets from its parent corporation."

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New Brunswick Will Build 12,500-Kw. Chatham Plant

To provide electricity along the northern shore of New Brunswick and to make possible further expansion of its rural electrification program, the New Brunswick Electric Power Commission will erect a 12,500-kw. plant on the harbor front about a mile from the center of Chatham. Construction of the plant, which will cost approximately $2,000,000, is to be started in April.

Transmission lines will connect the Chatham plant with the commission plant at Moncton in order to allow an interchange of power. The Chatham plant is to have facilities to receive coal by either water or rail.

The new unit will operate at 3,600 rpm., generating electricity at 6,900 volts with steam at 600 psi. and 825 deg. F. The boiler, using pulverized coal, will furnish 140,000 lb. of steam per hour.

New Mexico P.S.C. Begins Rate Study

Announcing a projected survey of possible utility rate reductions in a number of state urban areas, New Mexico Public Service Commission's first step will be a request to a number of utility firms to furnish reports on excess profits taxes paid the government since 1941.

Plans for the survey were announced shortly after the commission had approved a reduction in electric rates for New Mexico communities served by the El Paso Electric Co. The survey was requested by Gov. John J. Dempsey.

New Mexico utility firms which reported their excess profits taxes for 1944 to the commission, with the amount of the taxes for that year, are:

Albuquerque Gas & Electric Co., $340,986.11; Community Public Service Co., $137,795.01; Deming Ice & Electric Co., $57,439.14; El Paso Electric Co. (New Mexico portion), $67,220.18; Las Vegas Light & Power Co., $19,777.00; New Mexico Power Co., $120,515.00.

Companies which have not reported income and excess profits taxes for 1944 include Inland Utilities Co., New Mexico Electric Service Co., and Southwestern Public Service Co.

The electric rate reduction of the El Paso Electric Co. affects Las Cruces and small communities between it and El Paso, Tex., with reductions expected to total $17,222 annually in electric bills of 30,000 New Mexico customers. The new rates, which are like those put into effect last month in El Paso, are 4.5 cents per kw.-hr. for the first 50, 3 cents for the next 50, and 2 cents for all over 100 kw.-hr. They are said to be the lowest in New Mexico.

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N. Y. Union and Contractors Unite to Provide Housing

A no-strike, no-lockout agreement for the duration of the existing housing crisis has been announced in New York City by the Joint Industry Board of the Electrical Industry.

More than 10,000 electrical construction workers, members of the International Brotherhood of Electrical Workers, Local 3, and 364 electrical contracting companies are affected by the new agreement.

The union has voluntarily agreed to relinquish its contractual right to time and a half for overtime and offered to work two seven-hour shifts, both shifts at regular time until the housing shortage abates. The union also sanctioned the use of the most modern technological methods and the unrestricted use of high-speed, labor saving tools and devices in order to reduce the cost of low-rental housing and to make new dwellings available as soon as possible for returning veterans.

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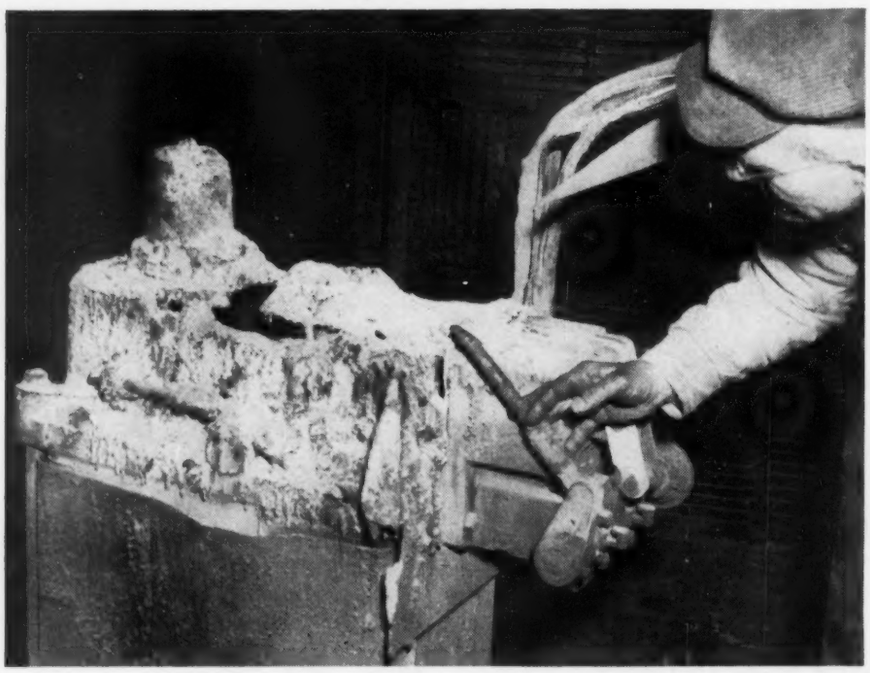
Mound Plant Fire Causes 7-Hour Service Cessation

An electrical fire in the 13-kv. bus structure at the Mound Street plant of the Union Electric Co. of Missouri, St. Louis, on January 16 put this station out of service for seven hours, causing an interruption to electric service that affected some 30,000 customers, including three hospitals.

The fire, which occurred at 4:45 p.m., is believed to have been caused by the mechanical failure of a bus-side bushing on a 13-kv. incoming line oil circuit breaker. The resulting short circuit and oil fire caused extensive damage to the station bus and complicated the task of restoring service.

Emergency crews working under severe handicaps were able to restore service to all but about a third of the customers by 9 p.m. Service was restored by 11:47 p.m.

Mound Street plant, where the fire occurred, served five substations of the former Laclede Power & Light Co. system which was taken over by Union Electric last April but which has not yet been completely integrated with the rest of the St. Louis system. The Mound plant was formerly the base load plant of the Laclede system.



WAS IT THE CAUSE?—Electrician examines ⅞-inch steel operating rod on a 13-kv. oil circuit breaker which was melted in half by the intense heat at a fire at the Mound Street plant of the Union Electric Co. of Missouri. Mechanical failure of a bushing on the pole of this breaker is believed to have caused the fire. Note molten porcelain

$140,000,000 Program Will Start This Year

Reclamation Bureau Has Money to Start Work on 30 Projects—Missouri Basin Items Included

The Reclamation Bureau will start construction this year on a $140,000,000 program of new dams, power plants, transmission lines and irrigation projects, most of them started before and delayed during the war.

Thirty projects will see work resumed or started with funds made available in the regular 1946 Appropriation Bill and in the $81,462,000 appropriated in the recently-enacted Deficiency Bill, and available as carry-overs from unexpended appropriations.

Two dams with power plants, and about 300 miles of transmission lines, all part of the joint Army Engineers-Bureau of Reclamation plan for development of the Missouri River Valley, are among the projects scheduled. They are the Boysen dam and power plant on Wyoming's Big Horn River; the Kortes dam and power plant, on Wyoming's North Platte River. Reclamation also will build transmission lines from Fort Peck Dam, in Montana, to Williston, N. D., to provide construction power for the Garrison Dam project, which the Army Engineers will start this year. Garrison is also part of the Missouri River development plan.

Eight other Missouri Basin projects authorized for the Reclamation Bureau will be started this year if Congress appropriates funds for them. Included in this group are the Canyon Ferry project, in Montana, where a 35,000-kw. plant is under study; the Glendo project, in Wyoming, where a 10,000-kw. plant is proposed; the Bostwick project, in Kansas, where a 2,000-kw. plant is proposed; and the Heart River project, in North Dakota, where a small plant for irrigation pumping only, is under study.

Work on the Columbia Basin project, the irrigation subdivision of the Grand Coulee dam project, will include clearing of land and some work at Grand Coulee itself, where two turbines are being removed and three are under construction.

Farther south, work on California's Central Valley project will be pushed after some years delay due to war-time restrictions. Included in projected work on this development is the construction of a 230-kv. transmission line from Oroville, Cal. to Sacramento and a short, inter-substation tie line there, as well as the installation in Shasta Dam of the two units from Grand Coulee.

Other power projects and the funds proposed for their power features in the 1946 regular and deficiency appropriation bills are as follows.

Parker dam, on the Colorado River in Arizona, $432,000; Colorado-Big Thompson project in Colorado, $3,625,000; Boise project, Idaho, Payette division, $624,000, Anderson Ranch division, $643,000; Palisades project, Idaho, $20,000; Hungry Horse project on the south fork of the Flathead River in Montana, (no power funds were appropriated, but dam construction funds were made available); Rio Grande project, New Mexico, $138,000; Deschutes project, Oregon, $288,000; Kendrick project, Wyoming, $630,000; Shoshone project, Wyoming, power division, $900,000.

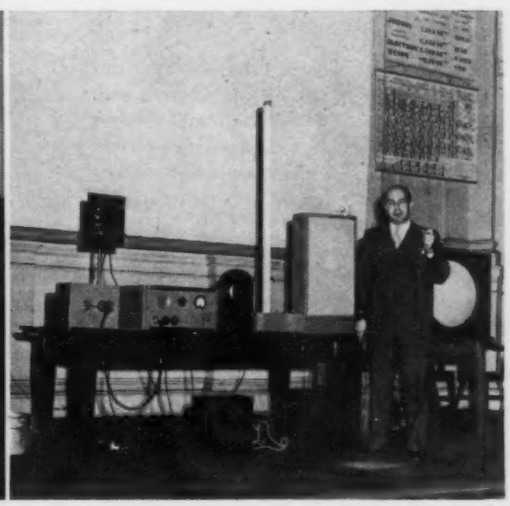
Europeans Not Interested; RFC to Get Floating Plant

Europeans have shown so little interest in purchasing one of the 30,000-kw. floating power plants which the Army has been operating in Belgium that the War Department is about ready to bring the craft home for disposal by the Reconstruction Finance Corporation.

There was some speculation as to whether disclosure of plans to return the plant to this country might not bring some response from foreign purchasers. One of the two "floaters" which the Army took to Europe has been returned to this country and is now up for sale by RFC. It had been expected the other would be sold abroad.

One federal official of long experience in the electric power business declared that while the boilers installed on the floating power plants are lighter than would have been chosen for land stations, the turbo-generators are standard equipment. The plants have been operated at efficiencies allowing 12,500 B.t.u. per kw.-hr. he said. Maintenance, he added, would run somewhat higher than on comparable size land installations.

Presently, RFC has the firm of Morris and Van Wormer making a valuation study of the Seapower, the unit now at Philadelphia Navy Yard and up for sale. Cost of the Seapower and the Resistance, the latter still in Europe, totaled somewhat under $4,000,000, including the cost of fitting them with prows and sterns for the ocean crossing and with equipment making them capable of 50-cycle operation. How much of this RFC would write off without argument as direct war cost is not known.



FEATURES OF WEDNESDAY MORNING SESSION OF A.I.E.E.—Left Panel, Participants in Edison Medal presentation. John C. Parker, vice-president of Consolidated Edison Co., who reviewed the career of the recipient, Philip Sporn; W. E. Wickenden, Institute president who made the presentation; Mr. Sporn; and Archer E. Knowlton, associate editor of ELECTRICAL WORLD, who gave the history of the medal. Right Panel, Dr. J. R. Dunning, director, Division of War Research, Columbia University, with some of the apparatus which he used to demonstrate his talk, "Development of Atomic Energy"

Utilities Cooperate to Get Boulder Power

Permission to distribute excess Boulder Dam power through facilities owned by Southern California Edison Co. by California Electric Power Co. was granted last week on a basis of a 42-year contract from the California Railroad Commission. A departure from usual policy, the agreement is related to basic Boulder contracts of similar length, the Commission said.

The power, assigned to Metropolitan Water District in southern California, had been intended for use by the RFC and suspended operations at the Basic Magnesium plant at Las Vegas, Nev.

Surplus energy now has been divided, with 55 percent going to the City of Los Angeles, 40 percent to Southern California Edison, and 5 percent to California Electric Power. In the Edison-California Electric contract, provision regarding the latter's share of power stipulates delivery on demand charge of $1 a kw. of monthly maximum demand for the first five years, with rates after that to be calculated on a cost formula contained in the contract. California Electric pays not less than 90 percent of its allotted energy at a 70 percent load factor, and pays Edison for generating charges at Boulder. In addition, it handles energy charges direct with the government.

The California Railroad Commission, praising the new contract as a trend toward cooperative use by companies of "inescapable investment capital utilities," promised to conduct periodic investigations of the agreement.

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FPC Ruling Paves Way for Nebraska Power Sale

The Federal Power Commission ruled this week that it has no jurisdiction over an application by the Nebraska Power Co. for authorization to issue securities, the proceeds of which would be used to redeem all its outstanding cumulative 6 and 7 percent preferred stock.

Commissioners Leland Olds and Nelson Lee Smith dissented. The order was signed by Commissioners Draper, Sachse, and Wimberly. No opinions are available at this time, FPC officials announced.

The majority ruled that the company became indirectly wholly owned by the Loup River Public Power District, a political subdivision of Nebraska, on December 26, 1944, when its common stock was purchased from the American Power & Light Co. by the Omaha Electric Committee, Inc., a non-profit organization formed to conduct the properties from private to public ownership. The Omaha Electric Committee was held to be an instrumentality of the Loup district.

Effect of the Commission's action was to remove the last federal barrier to complete consummation of the sale of Nebraska Power. The Securities and Exchange Commission washed its hands of jurisdiction long since. At present, a subcommittee is studying the Nebraska sale as part of its investigation of the administration by SEC of the Public Utility Holding Company Act but little that might affect the Nebraska sale is expected to result from the investigation.

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Melrose Power Co. Sold

Sale of the Melrose Power Co. to the Farmers Electric Cooperative Inc., Clovis, N. M., has been approved by the New Mexico Public Service Commission. Sale price was reported to be $56,000. The utility serves Melrose, N. M.

Utility District Wins Fight for Distribution Facilities

Another phase of a long battle between Sacramento (Calif.) Municipal Utility District and Pacific Gas & Electric Co. occurred last week when the Third District of Appeals at Sacramento ruled that the utility district was entitled to possession of electrical distribution facilities it has been seeking for twelve years. It was expected that the suit would carry after 30 days to the State Supreme Court.

Arguing that the California Railroad Commission's valuation of $11,632,000 on the properties was too low, P. G. & E. also contended that inclusion of side properties in the issue had no bearing on the case.

Continuous litigation by P. G. & E. has kept the Sacramento 640-square mile utility district from serving electrical users in the area since 1934.

MEETINGS

National Association of Corrosion Engineers—Annual convention, President Hotel, Kansas City, Mo., May 7-9. Elton Sterrett, executive secretary, 318 Southern Standard Bldg., Houston, Texas.

Great Lakes Power Club—Spring meeting, Palmer House, Chicago, Ill., May 24. Almer Skretting, secretary-treasurer, Wisconsin Electric Power Co., Milwaukee 1, Wisc.

Pennsylvania Electric Association—Engineering Section, all committees, Penn Harris Hotel, Harrisburg, Pa., May 28-29. E. B. Shew, chairman, Philadelphia Electric Co., Philadelphia 5, Pa.

Previously Listed

National Association of Purchasing Agents—Public Utility Buyers' Group, midwinter convention, Edgewater Beach Hotel, Chicago, Ill., February 4-5. R. C. Wenz, chairman, Philadelphia Co., Pittsburgh 19, Pa.

Pennsylvania Electric Association—Systems operation committee, Roosevelt Hotel, Pittsburgh, Pa., February 6-7; A. R. Deck, chairman, Metropolitan Edison Co., 412 Washington St., Reading, Pa. Rural committee, PEA headquarters, Harrisburg, Pa., Feburary 7-8; W. H. Ferguson, chairman, Duquesne Light Co., Pittsburgh, Pa. Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 7-8; C. C. Moler, chairman, The Potomac Edison Co., Hagerstown, Md. Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 14-15; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

Canadian Electrical Association—Winter conference, Chateau Frontenac, Quebec City, February 11-12. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal, Canada.

Missouri Valley Electric Association — Power sales conference, Hotel Continental, Kansas City, Mo., February 13-14; engineering conference, Hotel Continental, Kansas City, Mo., April 10-12. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Edison Electric Institute—Transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 18-19; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 20-21; general sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials — Spring meeting, Pittsburgh, Pa., February 25-March 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

National Rural Electric Cooperative Association—Annual meeting, Buffalo, N. Y., March 4-6. Avery C. Moore, secretary-treasurer, 416 5th St., N. W. Washington 1, D. C.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City 2, Okla.

North Central Electrical Industries—Convention and trade exposition, Radisson Hotel, Minneapolis, Minn., March 11-13. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Southeastern Electric Exchange — Engineering and Operation Section, Tutwiler Hotel, Birmingham, Ala., March 14-15; annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 24-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

American Society of Mechanical Engineers—Spring meeting, Hotel Patten and Reid House, Chattanooga, Tenn., April 1-3. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 3-5. S. E Winston, director, Illinois Institute of Technology, Chicago 16, Ill.

National Electrical Manufacturers Association — Spring meeting, Palmer House, Chicago, Ill., week of April 8. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Electrochemical Society — Spring meeting, Tutwiler Hotel, Birmingham, Ala., April 10-13. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

National Electrical Wholesalers Association—Annual convention, Stevens Hotel, Chicago, Ill., April 21-25. C. G. Pyle, managing director, 500 Fifth Ave., New York, N. Y.

Society of the Plastics Industry—National plastics exposition, Grand Central Palace, New York, N. Y., April 22-27. John Wetherby, secretary, 295 Madison Ave., New York 17, N. Y.

American Institute of Electrical Engineers—Northeastern district, Buffalo, N. Y., April 24-25. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

International Lighting Exposition — Stevens Hotel, Chicago, Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Blvd., Chicago 54, Ill.

Utah Utility Reorganization Plan Gets Court Approval

U. S. District Judge Tillman D. Johnson, Salt Lake City, has signed an order allowing the Utah Power & Light Co. to proceed with reorganization plans already approved by the Securities and Exchange Commission.

The hearing had been previously postponed by the court from December 19, because an objector, Lazarus S. Heyman, New York City, was unable to be present at the earlier date, (ELECTRICAL WORLD, January 5, Page 80). Heyman failed to appear at the hearing although he sent the court a written objection.

Under the reorganization plan the Utah utility firm will sever financial connections with Electric Power & Light Corp., which previously held all of the company's common stock, and from Electric Bond & Share. A new common stock of $20 stated value will be exchanged for all outstanding preferred stock at a ratio of 4⅞ shares for each 7 percent preferred share and 4⅜ shares for each 6 percent preferred. A cash payment of $650,000 will be made to Electric Power & Light for Utah Power & Light's old common stock of which the holding company has 3,000,000 shares.

The new simplified capital structure will consist only of debts and common stock, of which there will be 1,185,241 shares outstanding.

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Utility Operating Revenues Rise 0.3% in October

Electric operating revenues of the larger privately owned electric utilities in the United States in October, 1945, were $258,058,000, compared to $257,267,000 in October, 1944, an increase of 0.3 percent, according to preliminary figures released by the Federal Power Commission.

Revenue deductions (including operating expenses, depreciation and taxes) were $189,033,000 or 4.2 percent under those of October, 1944.

Gross income, including other utility operating income, increased 14.1 percent to $75,236,000 and net income in October, 1945, was $40,521,000, an increase of 7.8 percent from the net for October, 1944.

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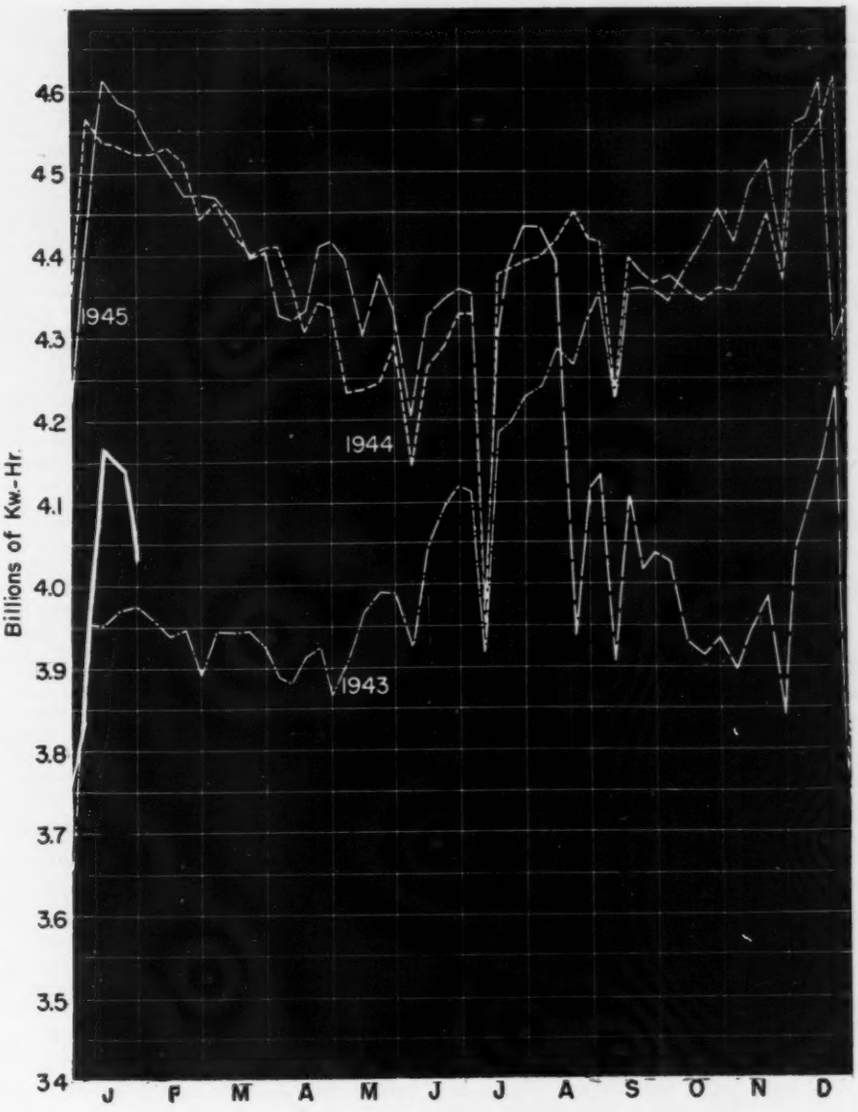
Heads Power Commission

A. L. Macdonald, who became premier of Nova Scotia several months ago, is also acting as chairman of the Nova Scotia Power Commission. His predecessor, A. S. MacMillan, also held both positions.



Electric Output Curve Loses Ground

The electrical output curve moved downward again during the week ended January 26, 1946, according to preliminary figures released by the Edison Electric Institute. Final figures were delayed by the wire strike.

E.E.I. placed the estimated amount of electrical energy distributed by the light and power industry for the week ended January 26 at 4,040,000,000 kw.-hr., compared with 4,145,116,000 kw.-hr. (revised) during the preceding week. During the week ended January 27, 1945, the amount of electrical energy distributed amounted to 4,576,713,000 kw. hr., this year's estimate representing a decrease of 11.7 percent. For the week ended January 19, 1946, the output represented a decrease of 9.7 percent (revised) as compared with the corresponding week of 1945.

For the second consecutive week the Rocky Mountain States was the only group which reported a gain over last year—3.3 percent. All other regions showed losses. The largest decrease was reported by the Central Industrial states —18.4 percent.

Weekly Output Millions Kw.-Hr.

1946		1945		1944	
Jan. 26	4,040*	Jan. 27	4,577	Jan. 29	4,524
Jan. 19	4,145	Jan. 20	4,588	Jan. 22	4,532
Jan. 12	4,163	Jan. 13	4,614	Jan. 15	4,539
Jan. 5	3,865	Jan. 6	4,427	Jan. 8	4,568
1945		1944		1943	
Dec. 29	3,759	Dec. 30	4,226	Jan. 1	4,337†
Dec. 22	4,239	Dec. 23	4,617	Dec. 25	4,295
Dec. 15	4,154	Dec. 16	4,563	Dec. 18	4,613
Dec. 8	4,097	Dec. 9	4,538	Dec. 11	4,567
Dec. 1	4,043	Dec. 2	4,524	Dec. 4	4,560
Nov. 24	3,841	Nov. 25	4,369	Nov. 27	4,403
Nov. 17	3,985	Nov. 18	4,450	Nov. 20	4,513
Nov. 10	3,948	Nov. 11	4,397	Nov. 13	4,483

†1944

Percent Change from Previous Year

	Week Ending Jan. 26*	Jan. 19	Jan. 12
New England	— 5.6	— 2.5	— 4.6
Mid Atlantic	— 5.3	— 4.6	— 4.9
Central Industrial	— 18.4	— 14.5	— 12.0
West Central	— 4.0	— 2.8	— 0.2
Southern States	— 11.2	— 10.5	— 10.9
Rocky Mountain	+ 3.3	+ 6.1	— 0.2
Pacific Coast	— 14.2	— 12.4	— 16.1
Total United States	— 11.7	— 9.7	— 9.8

* Preliminary. Final figures delayed by wire strike.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

TEXAS UTILITIES CO. lost an SEC decision when the commission recently rejected its proposal to enter competitive bidding for all 32,000 share of common stock of Dallas Railway & Terminal Co., now owned by Electric Power & Light Corp. Texas Utilities was formed last year by American Power & Light Co. to secure and control certain Texas subsidiaries of that company and Electric Power & Light which are intermediate holding companies in the Electric Bond & Share system. The commission held that the standards of Section 10 of the Holding Company Act do not permit a combination of electric and transportation properties in a holding company system unless a substantial operational relationship exists between the properties. The commission also pointed out that Texas Utilities is presently both a registered holding company and a subsidiary of a registered holding company and, in both capacities, its proposed acquisition is subject to the provisions of Section 10 of the Act. (Release No. 6373).

CRESCENT PUBLIC SERVICE CO. must modify its divestment and liquidation plan within fifteen days or the plan will not be approved, SEC recently ruled. Crescent's assets consist of three widely scattered utility subsidiaries. If the specified amendments are not filed within the time limit, the commission stated, it will issue an order disapproving the plan and directing Crescent to divest itself of its interest in Empire Southern Service Co., in Colorado Central Power Co., and then liquidate and dissolve. Under its plan, Crescent proposes to sell its interests in these subsidiaries and distribute the proceeds, estimated at $1,500,000, to the trustee under Crescent's income bond indenture for use in connection with the plan. Crescent also proposed to transfer $300,020; 1,972 preferred shares, and all of the common shares of its third subsidiary, Central Ohio Light & Power Co. to Central Ohio in connection with the latter's proposed recapitalization and to acquire from Central Ohio all 84,000 shares of the new common stock to be issued by that company. In its decision, the commission objected to Crescent's proposal to offer its income bondholders thirty shares of the new common stock of Central Ohio and $180 in cash for each $1,000 of bonds. The suggested exchange, the commission declared, would provide the bondholders "with more than the fair equivalent of their bonds and would be unfair to the common stockholders of Crescent." The plan should be amended, the SEC asserted, to provide for the payment of $80 instead of $180 and also to provide that the company expressly reserve the right to call its income bonds pursuant to the indenture at any time before the exchange offer is made. (Release No. 6378).

Hearing Scheduled

FEBRUARY 4: To consider the proposed merging of the Marion-Reserve Power Co. and Ohio River Power, Inc., into the Ohio Public Service Co. These three subsidiaries of the Cities Service Power & Light Co. stated in their application that they desired to combine in one corporate entity electric utility assets constituting a single integrated system as well as to reduce operating expenses and interest and preferred dividend charges. If the commission approves, all the outstanding preferred stock of Ohio Public Service and Marion-Reserve Power held by other than Cities Service Power & Light will be converted into 4 percent cumulative preferred stock of the surviving company on a share-for-share basis plus a cash adjustment. It is proposed that, upon consummation of the merger and related transactions, there shall be no more than 156,332 shares of the new preferred stock outstanding. Consequently, upon stockholders' approval of the merger, all holders of preferred stock of the present three companies would be afforded an opportunity to sell the new preferred stock to the surviving company at $105 per share plus accrued dividends. The surviving company also would offer to pay to preferred stockholders who dissent from the merger the redemption price of their shares and accrued dividends. The plan also provides that the common stock of Ohio Public Service shall continue to be common stock of the surviving company. If the merger becomes effective, the surviving company would sell at competitive bidding $32,000,000 of first mortgage bonds, due 1976, and $5,500,000 of debentures, due 1956. The net proceeds, together with the $5,000,000 to be paid by Power & Light for 50,000 shares of common, will be used to redeem the debt securities including interest overlap, retire publicly held preferred stock, and make cash adjustments on conversion of shares of preferred stock, and expenses incident thereto. (Release No. 6379).

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Texas Power & Light Co. Plans $4,000,000 Program

A $4,000,000 expansion program will be carried out in 1946 by the Texas Power & Light Co., President John W. Carpenter has announced.

Top priority will go to an 85-mile transmission line which will be constructed from Jewett, Leon County, to Lufkin, where a large substation will be built. Almost 1,000 miles of rural lines will also be built. The capacity of many substations will be increased.

UTILITY REPORTS

	Net Income 1945	1944
*Carolina Power & Light	x$ 2,301,325	$ 2,350,114
*Hartford Electric Light	x 2,765,415	2,055,104
†Mountain States Power	657,237	627,027
‡National Power & Light and subs	3,663,857	4,076,234
*Public Service of N. J. and subs	15,995,081	15,690,658
†San Diego Gas & Electric	1,493,932	1,468,837

*Twelve months ended December 31.
†Twelve months ended November 30.
‡Twelve months ended October 31.
xPreliminary.

October Energy Sales Decline 9.5%

Sales of electric energy to ultimate customers in October, 1945, totaled 14,902,206,000 kw.-hr., compared with 16,459,592,000 kw.-hr. in October, 1944, a decrease of 9.5 percent, according to the report issued by the Edison Electric Institute.

Classification of Sales, October, 1945 and Change from 1944

Kilowatt-hour sales October	Million Kw.-Hr. 1945	1944	% Change
Resident or domestic	2,789	2,547	+9.5
Rural (Distinct rural rates)	390	373	+4.5
Commercial or industrial			
Small light & power	2,509	2,502	+0.3
Large light & power	7,826	9,559	—18.1
Street & highway lighting	197	193	+2.0
Other public authorities	555	656	—15.3
Railways & railroads			
Street & interurban	371	373	—0.7
Electrified steam railroads	217	220	—1.2
Interdepartmental	48	37	+29.6
Total to ult. customers	14,902	16,460	—9.5

Revenue from ultimate customers amounted to $271,413,100 in October, compared with $273,700,000 in October, 1944, a decrease of 0.8 percent.

For the twelve months ended October, 1945, the annual use per customer advanced to 1,208 kw.-hr. from 1,137 for the preceding year, an increase of 6.2 percent; the average annual bill to $41.56 from $40.14, an increase of 3.5 percent; revenue per kilowatt-hour dropped to 3.44 cents from 3.53 cents, a decrease of 2.5 percent.

•

Pacific Gas & Electric Co. Will Set Up Pension Fund

In San Francisco, the Pacific Gas & Electric Co. will soon set up a $13,600,000 trust fund which, with the income therefrom, will be used for the payment to employees of retirement incomes. This is in addition to a previous retirement insurance plan established by the company early in 1937.

The trust funds, which will be invested initially in P.G.&E.'s first and refunding mortgage, 3 percent bonds, are secured by a mortgage on all the properties of the company.

Beginning July 1, all P.G.&E. employees will be required to retire at their normal retirement dates. Those working at present who are beyond their retirement dates will be retired sometime between now and July 1. A proviso, however, indicates that special cases will be determined individually in order to reemploy any employee so retired at a compensation.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

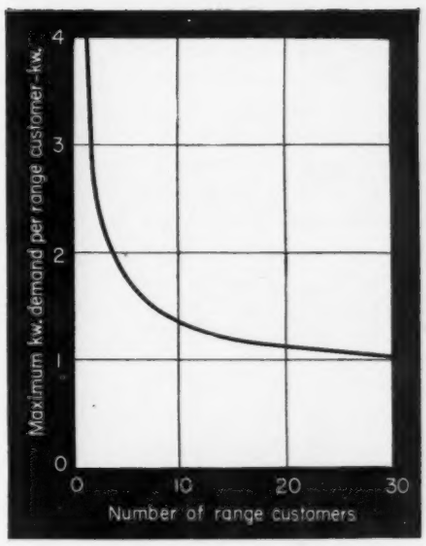
Tables Yield Data On Range Service Needs

The two accompanying tables are used on the system of the Interstate Power Co., Dubuque, Iowa, to estimate the transformer size required to serve various numerical combinations of range and customers and to determine the allowable length of 230-volt secondary over which different numbers of range customers can be served without exceeding a 12-volt drop to the furthest range.

Since the exact origin of the data in Table I listing the transformer size required to serve various groupings of range and non-range customers was not known, its accuracy was tested and verified by recording ammeter instrument installations on actual transformers before being accepted for use on this company's system.

Requirements of secondary feeders supplying from one to nine electric range customers are summarized in Table II. This table lists the maximum demand imposed on a secondary feeder supplying various numbers of ranges (non-range customers neglected) and gives the allowable distance from the transformer to the furthest range customer for a maximum of 12 volts drop for No. 4 and No. 6 wire. Data is given for the condition where ranges are distributed along the feeder and grouped at the end.

The values of maximum feeder demand which are listed in Table II were calculated from the accompanying expectancy curve. The maximum demand per customer from the curve was multiplied by the number of customers and the resulting figure increased by one-third.



EXPECTANCY CURVE — This graph yields maximum feeder demand per customer to be expected in serving various numbers of range customers

Table I—Transformer Capacity Required to Serve Various Combinations of Range and Non-Range Customers

No. Range Customers..	1	1	1	2	2	3	3	3	4	4	5	5	5	6	6	6	7	7	7
No. Other Customers...	6	27	75	14	39	7	31	56	22	47	15	40	90	11	36	86	6	30	80
Transformer Size.....	3	5	5½	5	7½	5	7½	10	7½	10	7½	10	15	7½	10	15	7½	10	15
No. Range Customers..	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15			
No. Other Customers...	20	70	16	67	7	56	4	55	47	147	38	138	35	134	30	130			
Transformer Size.....	10	15	10	15	10	15	10	15	15	25	15	25	15	25	15	25			

Table II—Requirements of Secondary Feeders Supplying Residential Ranges

No. Ranges on 230 v.	Max. demand on feeder at transformer		Allowable Distance to Furthest Range in Ft. Ranges Grouped at end		Ranges distributed	
	kw.	amp.	No. 6 Wire	No. 4 Wire	No. 6 Wire	No. 4 Wire
1	4.8	21	710	1140	710	1140
2	7.4	32	470	750	570	910
3	9.0	39	380	610	490	780
4	10.8	47	320	510	430	690
5	12.0	52	290	460	390	630
6	13.2	57	260	420	360	580
7	14.7	64	230	375	340	540
8	16.0	70	210	340	310	500
9	17.1	74	200	320	300	470

Impregnated Glass Substitute for Mica

Due to the shortage of mica for use as insulation between commutator segments for their motors, generators, and dynamotors, The Robert Bosch Co. (Stuttgart, Germany) developed a substitute material which they claim is superior in every way to mica and one which they plan to continue to use even though mica should again become available. The trade name for this material is "Glushartgewebe;" it consists of several layers of impregnated glass fibre which have been bended together under heat and pressure.

The impregnation solution is prepared by mixing together the following

percentages of materials. It is mixed in a mechanical mixer until a homogenous mixture is obtained.

Material	Percentage by Weight
Resinol K-2 ..... (Not fully polymerized)	53.30
Alcohol (CR)	23.35
Osmose-Caoline	23.35
	100

The glass fabric is impregnated in a vertical type machine similar to those used in the United States for the production of varnished cambric. It is run at a speed of one meter per minute. The amount of impregnating material used per unit length is controlled by passing it through adjustable pressure rolls. The material travels about 14 meters in the oven. It enters the oven at room temperature and reaches a maximum temperature of 120 deg. C. at the top of the oven and then cools back down to room temperature by the time it emerges from the bottom of the oven. Approximately 42 kilograms of the impregnating material is required per 100 meters of the fabric. The alcohol is recovered.

The impregnated material is then cut into strips 1,500 by 95 mm. This is folded into three thicknesses lengthwise and molded under heat and pressure.

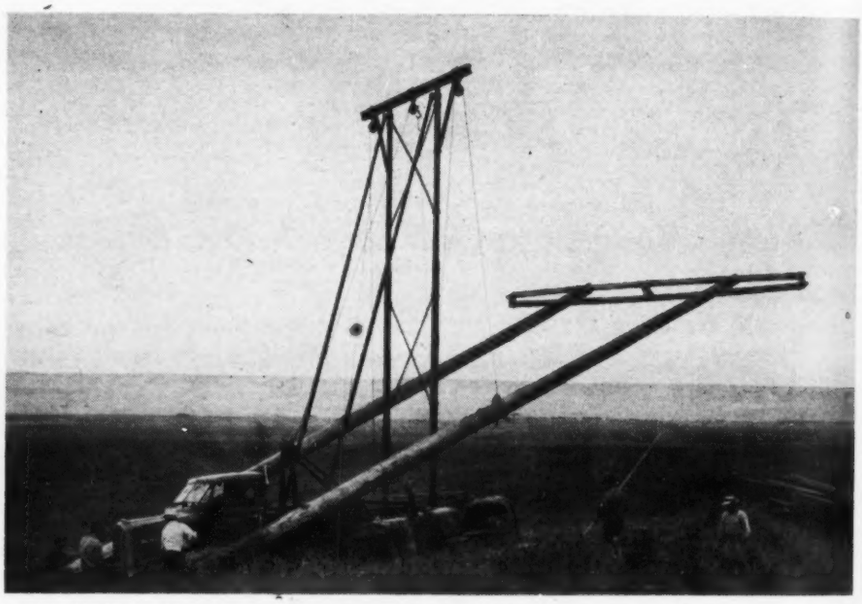
The material is not thermoplastic and to obtain uniform thickness the excess impregnating material must be displaced mechanically. It is pressed under a pressure of 350 kilograms per square centimeter at a temperature of 160 deg. C. for a period of five minutes. No cooling cycle of the press is required since the material does not change in dimension when removed from the press hot.

This material can be exposed to a continuous temperature of 250 deg. C. and temporarily to 320 deg. It is nonhygroscopic, no change in either weight or dimensions when exposed to a relative humidity of 100 percent and temperature of 21 deg. C. for 24 hours. Thickness can be held to 0.055 plus or minus 0.0001 mm. The material is tested for electrical breakdown at 1,000 volts but it, of course, will stand many times that much voltage. They had no information on insulation resistance of the material or the effect of humidity on insulation resistance, according to the Department of Commerce release from which the above was adapted.

1/3 Labor Saving with Two-Boom Derrick

Experience gained on a number of transmission line jobs led H. H. Walker, electrical contractor, to develop a double-boom, truck-mounted derrick to save one-third the structure-erection cost in building a 115-kv., wood pole line for Bonneville Power Administration. Preceding this particular piece of equipment was a two-boom derrick mounted on a wide-tread trailer drawn by a tractor. This proved so successful that the boom was then mounted on a five-ton, heavy-duty Walters four-wheel-drive truck for better maneuverability.

Telescoping vertical members are made of 4½-in. O.D. top section and 5½-in. O.D. lower, extra high-strength tubing mounted on 7-ft. 6-in. centers. Height is adjustable up to 36 ft. by means of a series of holes. Back members, also adjustable, consist of 3-in. top and 3½-in. lower O.D. tubing of the same material. Cross member at top is 18 ft. long made from two pieces of 8-in. channel iron, back to back. Eyebolts, adjustable lengthwise for spacing, are provided for sheaves for $\frac{9}{16}$-in. flexible steel lines from a double-drum winch.



TRUCK-MOUNTED, two-boom derrick cuts field labor costs in erecting H-frame, wood pole, 115-kv. line structure. An average of 20 structures was set per day

H-frame structures with 90-ft. poles, weighing four tons, have been set. Average number of general run structures set per day was 20, representing a labor saving of one-third over setting the poles singly and framing in the air. No trouble was experienced with wrenching or damaging of the structures as is often the case with a single boom and bridle.

• • •

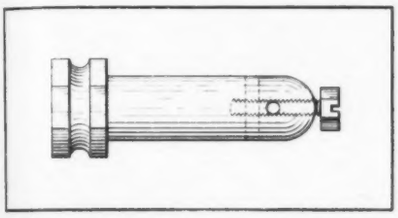
Improved Adapter Has Meter Testing Advantages

For some time the Philadelphia Electric Co.'s meter testers have been using terminal stud adapters designed for use with heavy flexible jumpers equipped with split-sleeve pressure connectors for bridging customers' loads during meter tests on 50-amp. single and polyphase self-contained watthour meters, while the clip-type jumper was still used by the routine meter testers for bridging the smaller meters during test.

A recent improvement in these adapters, which was devised by John L. Stemper, Jr., of the Philadelphia Electric Co.'s meter department, permits their additional use for bridging the smaller meters without requiring the routine tester to carry the heavy flexible jumpers used for bridging the larger meters. This was accomplished

by drilling two small holes through the body of the adapter, offset 90 degrees with respect to each other, to accommodate a No. 10 AWG wire, and drilling and tapping the upper end of the adapter for a No. 10-32 set screw which holds the short No. 10 jumper wire securely in place.

This simple change in the adapter



HOLES IN THE SIDE of the adapter for the insertion of a No. 10 wire, and a No. 10-32 set screw at the end to hold the wire securely in place

design now provides an adequate and safe method for bridging customers' loads during tests on the smaller sizes of meters comparable to that formerly attained with the original adapter on the larger capacity installations. Some advantages of this method of bridging loads are (1) the current-carrying capacity of the adapter and the securely connected No. 10 wire jumper exceeds that of the clip-type jumper, (2) it reduces congestion around the meter test block considerably over that existing when clip-type jumpers are used, thus providing more space for making test connections after the jumpers are placed and (3) the rigid connection minimizes the possibility of service interruptions and short circuits that may occur should a clip-type jumper accidentally fall or drop off a service terminal during the test.

•

"Shuttle" Conveyor Simplifies Coal Handling

Coal "shuttle" conveyor in the Erie, Pa., Front Street station of the Pennsylvania Electric Co. simplifies the coal handling problem. It eliminates all buckets, can be positioned over any of the seven bunkers and makes it possible for one operator to replenish the coal at the rate of 150 tons per hour.

The conveyor travels on a 100-ft. light gage track (formed of ¼-in. by 2-in. by 2-in. angle iron) to reach the bunkers of the four high-pressure boilers and the three low-pressure boilers. It is provided with a 5-hp., 440-volt motor for propulsion along the tracks as the coal burning operations of the boilers demand. When filling the bunker at the further end of the room (see illustration), the conveyor extends into a previously unused room beyond the wall.

The 24-in. leather conveyor-belt has a 108-ft. travel between the two end drums. It travels at a linear speed of 80 ft. per min. and is driven by a second motor of the same horsepower and voltage.

Coal is brought to the "shuttle" belt by a second belt which rises from the coal crusher at about a 15-deg. angle. Telephone communication is provided between the crusher and the "shuttle" belt room to provide for any emergencies which may arise.

COAL "SHUTTLE" conveyor travels on 200-ft. track over seven bunkers

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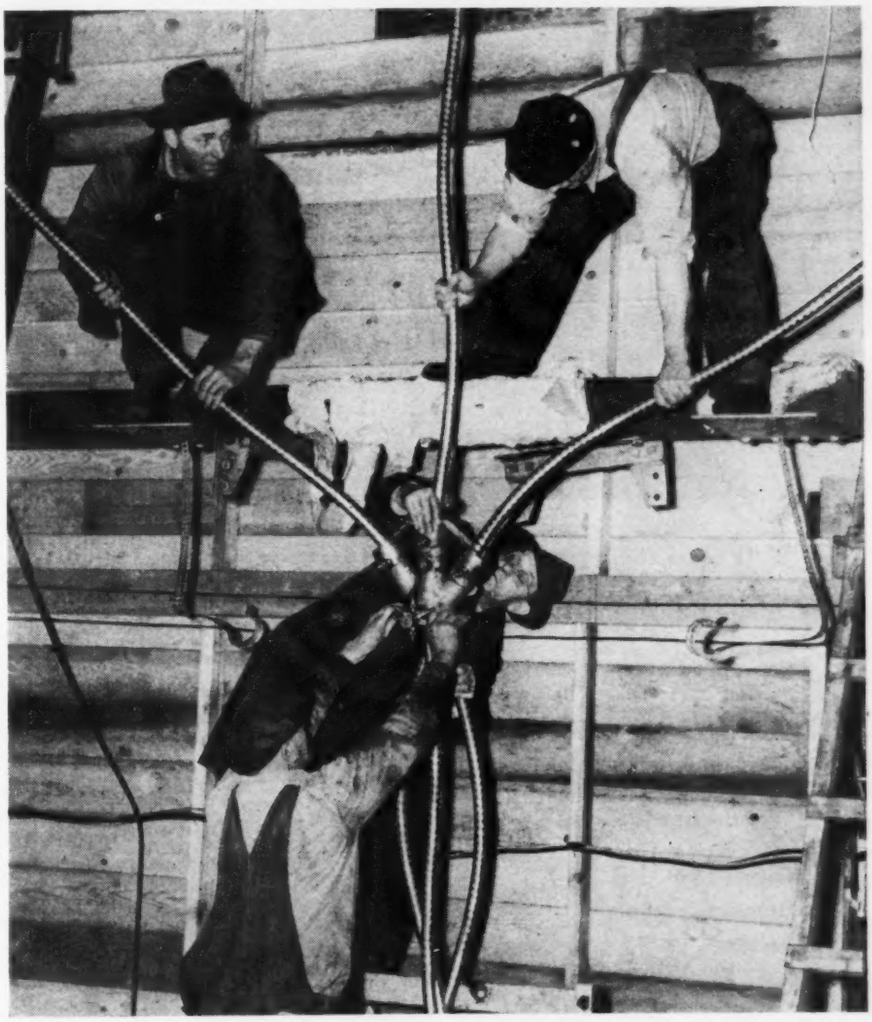
Installing Spreader



INSTALLING SPREADER on 110-kv. oil-filled cable. Experience has shown importance of protecting the cable shield from sharp edges in the spreader. This was done with a cloth tape, shown under the man's hand, tied through both sides of the spreader. Cable made by General Electric Co. was installed by Portland (Ore.) General Electric Co. across Willamette River to bring in additional Bonneville power

Distribution Staff Duties Summarized*

Service Estimator

The service estimator is required to investigate all new applications for service, stipulate the location of service entrances and meters, and interpret to contractors or prospective customers the special requirements of the company as published in pamphlet form. He is required to refer investigations involving additions to the primary distribution system, the installation or changing of transformers (or certain other features) to the company's maintenance engineer before proceeding to estimate the cost of doing the work. All such estimates, when completed, are required to bear the signature of the maintenance engineer.

The estimator is expected to figure the probable cost of making such changes as are necessary to give service to any applicant, and when the construction has been authorized, to be responsible for the preparation and issuance of the necessary work orders, plans, material issued tickets, etc. He must inspect all new wiring jobs in places outside of the city inspection district where there is no regular wiring inspector, and notify the distribution clerk when such jobs are ready to be connected to the company lines. He is expected to inspect such jobs at least once, if possible, while the work is in progress, and to keep a record of such inspections using the form provided. This staff man's duties also include obtaining necessary rights of way through private property when required for his own department or when requested by other departments.

Inspection of Inside Wiring

No. _____ St. _____
Owned by _____
Occupied by _____
Electrical Contractor _____
Rough work completed _____ Finished work completed _____
Ground - water pipe _____ driven ground _____
Light _____ Power _____
Defects _____

Inspector _____ Date _____

Remarks: _____

WIRING inspection form

In all cases where work is to be done or materials furnished by a customer for the purpose of constructing lines which are to become a part of the company's system, he is charged with the task of carefully inspecting such work or materials before any work is done on the job by the company's men. Such work or materials cannot be accepted unless they conform to the company's specifications. The service estimator is required to make such visits during the progress of the work as may be necessary to determine if the job is meeting the company's requirements.

* One of a series of presentations covering the essential duties of officials of a public utility distribution department serving between 50,000 and 75,000 meters. Organization of the distribution department was outlined in ELECTRICAL WORLD, October 13, 1945, page 106.

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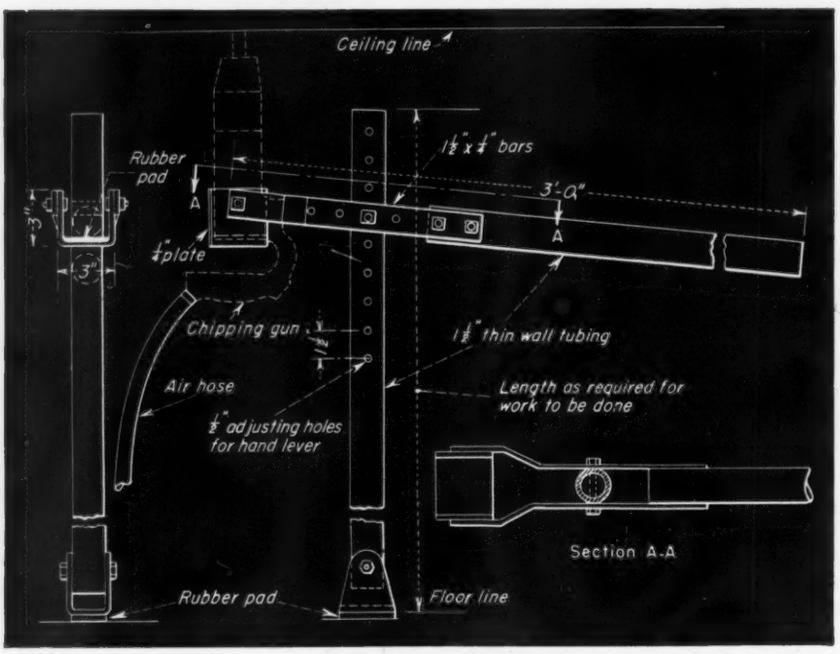
Adjustable Support For Overhead Drilling



ADJUSTABLE SUPPORT for overhead drilling operations

A device consisting of two major tubular parts—a vertical element on which is positioned at various elevations an approximately horizontal hand-operated lever—has been designed for overhead drilling operations. The adjustable support was developed by James I. Endicott, U. S. Bureau of Reclamation pipefitter at Grand Coulee Dam. He was rewarded by the Department of Interior.

The support operates effectively with an electric drill or with an air gun; a demonstration with the latter for A. N. Hanson, foreman, is illustrated. Working time on such overhead jobs has been cut by 50 percent.

By its use, the support also increases the safety factor in overhead work, and its efficiency varies according to the weight or pressure placed on the hand lever. Dimensions of the unit are given in an accompanying outline.

U. S. Bureau of Reclamation Photo

DEMONSTRATION of drill support developed by James I. Endicott (left)

•

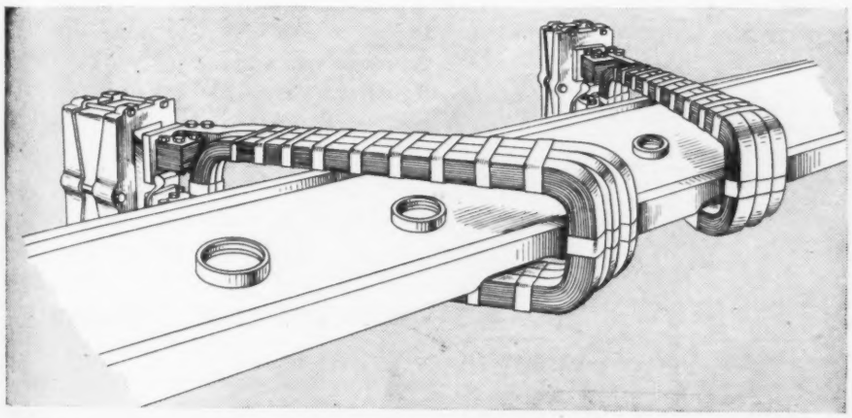
Demagnetizing Parts of Anti-Friction Bearings

W. F. BOWER
Plant Engineer, Gwynedd (Pa.) Plant, SKF Industries, Inc.

For the removal of virtually all traces of residual magnetism in ball and roller bearing parts after inspec-

tion and before assembly, SKF Industries, Inc., has developed and builds its own demagnetizers for use after grinding operations. Following is a description of a typical installation used after surface grinding.

All machines equipped with magnetic chucks have polarity reversing switches for partially demagnetizing the parts after grinding so that they may be removed from the chuck. In addition, many such machines are factory equipped with individual demagnetizers through which the finished piece is passed as it is removed from the chuck.



COILS arranged at predetermined angle to demagnetize anti-friction bearing races conveyed by a slowly moving canvas belt on wooden frame

Bearing rings are quite difficult to demagnetize because of their extreme hardness, and because of the fact that, dependent upon their position on the magnetic chuck during grinding, a ring contains two or more sets of magnetic north and south poles evenly spaced around the ring.

Therefore, it is our practice to remove the last traces of residual magnetism by passing the parts on a slowly moving conveyor through a strong pulsating magnetic field created by passing a heavy alternating current through a copper coil connected to the terminals of an arc welding or similar transformer.

We found by experiment that a single pass through a demagnetizer furnished with a grinding machine did not remove all the magnetic poles in the ring. Rotating a ring while in the field did the job, but was not practicable. It was found that installing two demagnetizers at an angle of from 60 to 90 deg. with respect to each other would produce the same effect as rotation of the ring. A single pass through two demagnetizers thus mounted has proven to do a good job and is our standard practice.

It is simple to test the magnetic flux remaining in a ring with a simple search coil and voltmeter, if a check is desired.

Each demagnetizing coil is made symmetrical and consists of 15 $\frac{1}{8}$-in. by $1\frac{1}{2}$-in. strips of round edge, soft annealed copper. Wrappings of asbestos cloth $\frac{3}{4}$ in. wide every 5 in. provide a spacing of approximately $\frac{1}{4}$ in. between turns of the coil and also hold the 15 copper strips compactly together. The coils have 3 in. by 31 in. inside dimensions for an 18-in. canvas belt on a wooden frame.

Each demagnetizer uses a 15-kva., 220-volt, 60-cycle, single-phase transformer with a 53:1 turn ratio. Current drawn from a 220-volt circuit is approximately 68 amp. The single-turn secondary is made up of $\frac{1}{8}$ in. gage by 4-in. wide copper bars.

Electrical control for the demagnetizer is connected so that if the conveyor is stopped, the demagnetizer is deenergized, as a steel ring or similar part stopped in the magnetic field will eventually become red hot from molecular friction and lose its temper. The maintenance man who previously had to repair the burned conveyor belt lost his temper, too.

•

Self-Coupled Parallel Operation

For tap-changing transformers up to 2,000 or 5,000 kva. (depending on voltage and range of regulation) a scheme for parallel operation has been devised in England which uses the regulator motor as a differential relay. In this way the directional relay, auxiliary relays, starting contactors and overload device are omitted because the motor responds to the differential in current when the tap-changing positions are not in synchronism and giving equal voltages.

As described by E. T. Morrison in a recent issue of *Electrical Review*, it involves the use of a split-phase motor of the induction-disk type to move the tap-changer. The current transformers are connected in the power transformer leads in the usual opposition, differential-protection manner. The motor for the "leader" transformer is used in the normal manner but for the "follower" the phase-splitting condenser is disconnected.

One phase winding P is permanently connected to a voltage source of suitable phase displacement. The second phase winding Q is connected to the current-transformer circuit.

Motor Operation

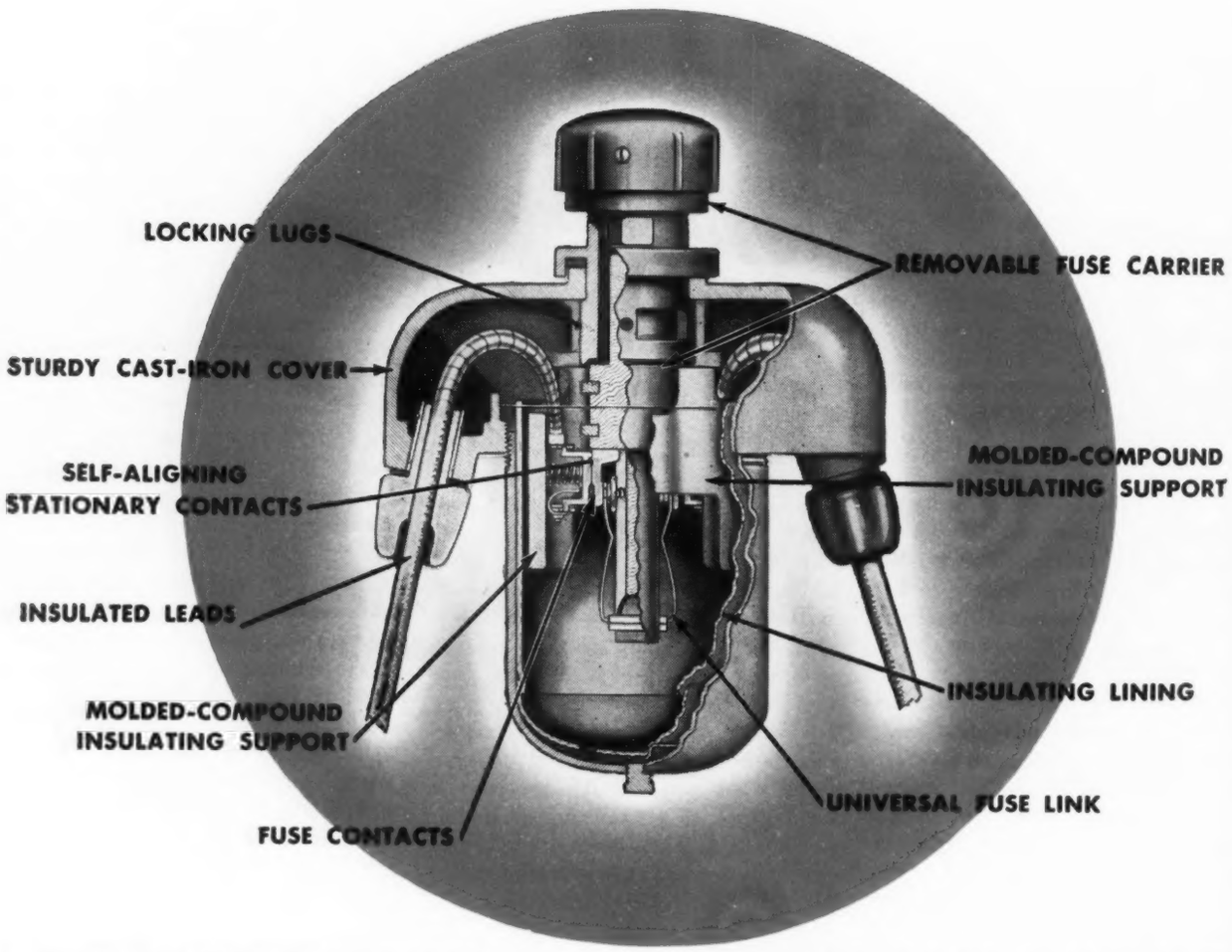
When the two transformers are in correct parallel operation (i.e., with similar voltage ratios) the current-transformer currents are equal and as a consequence of this there is no resultant current in the motor phase-winding Q and hence no driving torque in the motor.

When the "leader" transformer voltage is changed, either by manual operation or through the action of its automatic voltage relay, the resulting difference in currents of the "follower" transformer passes through the motor phase winding Q in a direction depending upon whether the voltage is raised or lowered. The motor, thereupon, starts up and brings the "follower" transformer voltage into line with the leader. When this is achieved the current in the motor phase winding Q vanishes and the motor stops. The process is almost uncanny to the observer since the motor apparently starts, runs and stops through no visible agency, as there are no switches or motor contactors or any moving parts in the "follower" motor circuit.

The volt-ampere rating of each current transformer is approximately Z/S times the phase volt-ampere rating of the motor where Z is the percent impedance and S the percent voltage step of the regulating gear. This is what, at present, limits the scope of application of the scheme.

"My increased interrupting rating makes the toughest cutout jobs easy for me!"

Improved G-E



STURDY CAST-IRON COVER with drawn-steel tank threaded in—designed for safety, to withstand much higher internal pressures than can occur within the cutout's interrupting rating.

INSULATING LINING on sides and bottom of steel tank.

MOLDED-COMPOUND INSULATING SUPPORT bolted to inside of cast-iron cover provides firm foundation for the two stationary contacts.

SELF-ALIGNING STATIONARY CONTACTS are flexibly mounted and bear against fuse contacts with strong spring pressure.

REMOVABLE FUSE CARRIER of oil-treated wood with strong metal cap—lifts vertically out of small opening in cover for easy fuse renewal.

LOCKING LUGS automatically hold and seal fuse carrier securely in the cutout, except when carrier is rotated to full open position. Cutout is therefore always ready for switching.

FUSE CONTACTS—rigidly mounted on fuse-carrier plug—have clamp-type terminals which support the fuse link.

UNIVERSAL FUSE LINK fits into notch provided in fuse-carrier plug. Note: Notch can be sawed in plugs of earlier cutouts to accommodate these new links.

INSULATED LEADS are siphon proof and enter the cutout above the oil level, through wet-process porcelain bushings.

Uses New, *Universal* Fuse Link — Has *New* Design Features — FOR BETTER PROTECTION, GREATER ACCURACY, LONGER CONTACT LIFE

OIL FUSE CUTOUT

"I'm built to deliver more circuit protection than ever," says this improved G-E fuse cutout. "With my new, universal fuse link, I have higher short-circuit interrupting capacity—can safely clear fault currents up to 11,000 amperes (depending upon my rating)—under circuit conditions tougher than fuse cutouts ever meet in service."

THE Textolite insulating support is stronger, gives higher flash-over level, and provides a more solid foundation for stationary contacts. These features add greater interrupting ability.

The contacts are designed to confine all arcing, when the circuit is opened, to special arcing surfaces well under the oil, keeping the load-carrying contact surfaces permanently clean. This permits repeated switching of load current —with either disconnecting blades or fuse links.

UNIVERSAL FUSE LINKS—an entirely new feature—replace earlier plain and reactive-type links. They can be used in the improved G-E cutout—and in older types too—with price savings of as much as 40 per cent over the superseded plain-type links, and even more, over the reactive type. These new universal fuse links reduce the number of items required in stock—one line of *universal* ratings is now applicable to 100-, 200-, and 300-ampere cutouts.

USE G-E OIL FUSE CUTOUTS where you require:

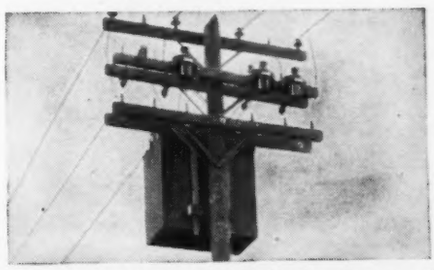
1. High interrupting capacity
2. Quiet and safe operation, with no exposed live parts and no expulsion of arc flame
3. Dependable operation when completely submerged
4. Gang operation of two or three units

NEW G-E UNIVERSAL FUSE LINKS carry 100 per cent of rated current continuously in 100-, 200-, and 300-ampere cutouts. The accuracy of their time-current characteristics equals that of G-E expulsion-type fuse links. When used in the improved cutouts, they permit higher continuous current ratings at 5000 volts, and increased interrupting ratings at all voltages. In the earlier cutouts, they permit interrupting ratings as high as the previous reactive-type links.

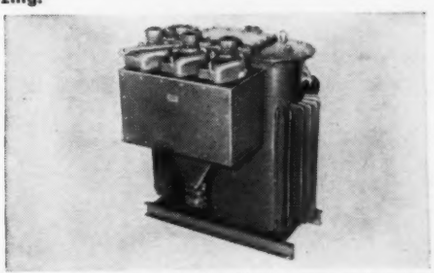
YOUR G-E REPRESENTATIVE can supply further information (HB 5350 to 54). Our descriptive booklet (GEA-732) is being revised and will be sent upon request as soon as it is completed. Address inquiries to your nearest G-E office or to General Electric, Schenectady 5, N. Y.

GENERAL ELECTRIC

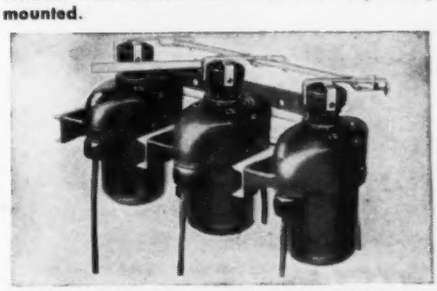
406-18-6254



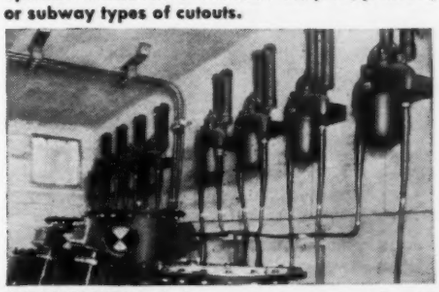
POLE-MOUNTED INSTALLATION of pole-type oil fuse cutouts. Can be used indoors or outdoors for connecting apparatus to lines or for line sectionalizing.



METAL-ENCLOSED ASSEMBLY with gang-operating mechanism—mounted directly on 3-phase transformer. Assemblies can also be separately mounted.



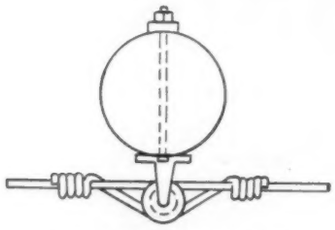
GANG ASSEMBLY (pole type) arranged for 3-phase operation. Mechanism available for pole, pothead, or subway types of cutouts.



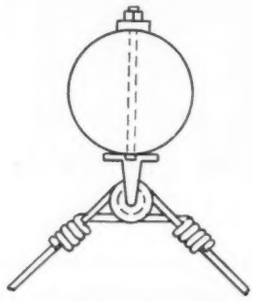
SUBWAY-TYPE oil fuse cutouts equipped with expansion chambers in underground vault. This type is advantageous for submersible or semi-hazardous locations.

HOW RACKS CAN BE USED ON POLES

Ten methods of rack construction are illustrated—corner angle, branch, crossing and through runs, and permanent and temporary dead ending. This adaptation has been made from Overhead Construction Standards of Central Hudson Gas and Electric Corp., Poughkeepise, N. Y.

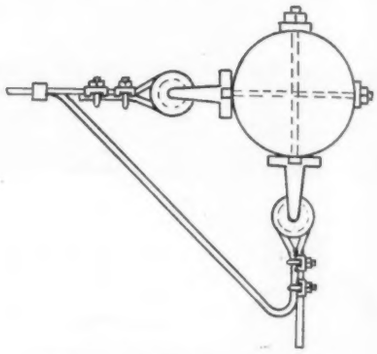


1—LINE POLE



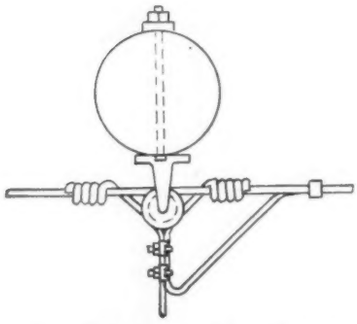
2—ANGLE POLE

Inside construction; all angles on "light" lines; angles less than 45 deg. on "heavy" lines

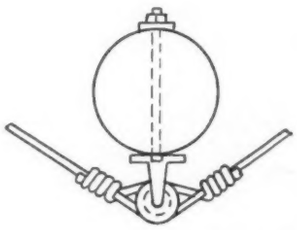


3—ANGLE POLE

Inside construction; all angles over 45 deg. on "heavy" lines

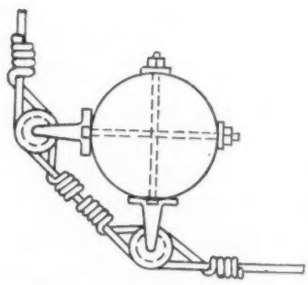


4—BRANCH POLE



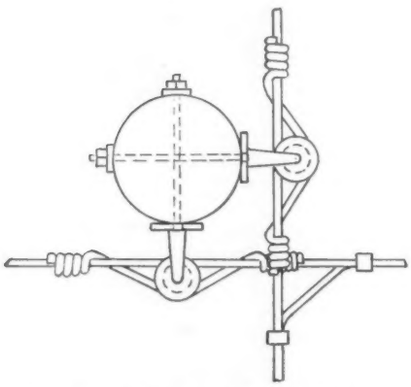
5—ANGLE POLE

Outside construction; all angles less than 45 deg. on all lines

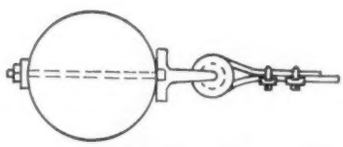


6—ANGLE POLE

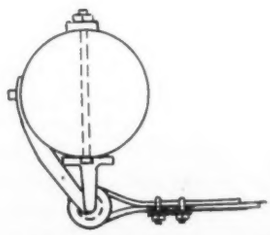
Outside construction; all angles over 45 deg. on all lines



7—CROSSING POLE

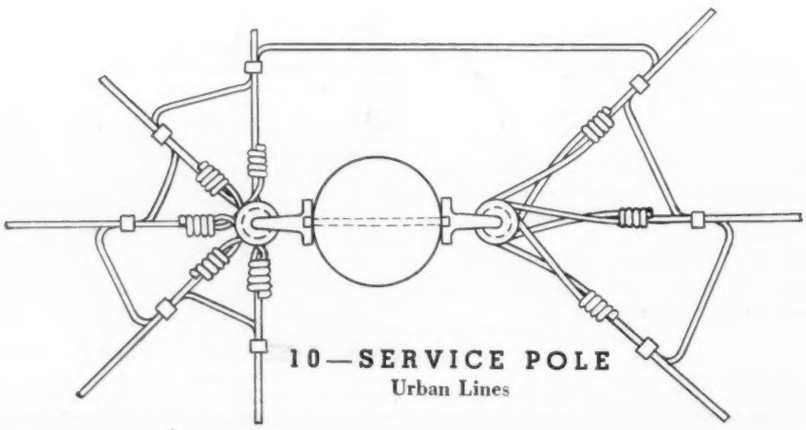


8—PERMANENT DEAD END



9—TEMPORARY DEAD END

For dead ending use Crosby clips; either one Eureka clamp or two Hubbard clamps.



10—SERVICE POLE

Urban Lines

NOTE:

Referring to Fig. 2, 3, 5 and 6 "light" and "heavy" are arbitrary terms. In general, "light" means No. 4 wires and smaller and "heavy" means wires No. 2 and larger. The terms are used since many secondaries consist of different sizes of wires: e.g., two No. 4 and one No. 6, which would be termed "light;" two No. 2 and one No. 4, which would be termed "heavy."

TIME WHEN YOU KNOW

Good it is

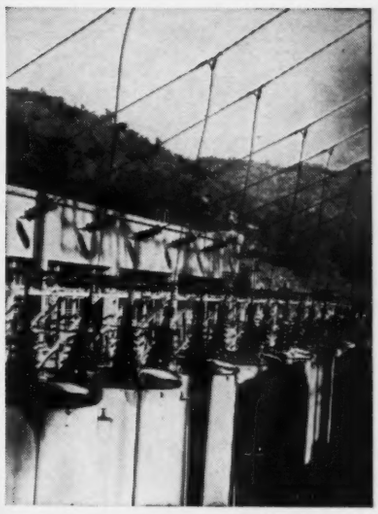
Three hundred years ago, some violin buyer of Cremona might have asked Stradivari, "How good is it?". Now all the world *knows!* And, in this respect, insulators and violins have much in common. When you have used a thing long enough . . . when it has performed faultlessly for many years . . . there comes a time when you forget the question, "How good is it?". You *know!*

Remember this important fact about insulators: The specifications that apply to the insulator you buy are specifications of a *new* insulator, but insulators don't *stay* new!

The one thing, however, that stays new in an O-B insulator is its ability to continue meeting the requirements for which it was originally intended.

This is the great point of difference you will find in any O-B insulator, and to an equal degree in O-B hardware . . . a capacity to *retain newness.* After years of actual use, there will come a time when you forget the question, "How good is it?". You'll *know!*

2643-H



Twenty-six years ago--in 1920--these O-B bushings went into service and have stayed on the job continuously without producing a trouble call.

These O-B switch insulators have rounded out more than 30 years of un-interrupted service on a large Mid-Western substation. Today, they appear quite capable of performing with the same high degree of operating satisfaction indefinitely.

AIR CONDITIONING STANDARDS
TEMPERATURE, HUMIDITY, VENTILATION

Determination of standards of temperature, humidity, air motion and air purity acceptable to a majority of people has been no easy task because there are substantial differences between individual reactions; there are, further, psychological and intangible as well as purely physiological effects.

The closest scientific measures of comfort are effective temperature charts, the results of comprehensive tests by the American Society of Heating and Ventilating Engineers on a variety of individuals under widely varying conditions.

Four Factors in Estimating Air Conditioning

Heat Inflow—For summer cooling, the heat sources which must be allowed for include the natural inflow of heat through the outside walls, windows, roof or ceiling and floors, which is the result of higher temperatures on one side of the structure forcing heat to flow to the colder side. A heat gain of this type is considered to be entirely sensible in its effect upon the room since it does not affect the moisture content of the enclosed space.

Another of the important heat loads is that generated by the occupants of the conditioned space.

Human Heat—The heat production of the normal human body at rest is about 400 B.t.u. per hour, of which slightly over 50 percent is considered as sensible heat and the remainder latent heat.

Electric Heat—Heat emitted by electric lights, motors and other equipment which may be operating in the conditioned space.

Injected Air—Hot outside air introduced by the air-conditioning equipment for ventilation or derived by natural infiltration through window cracks, door openings, etc.

RECOGNIZED VENTILATION STANDARDS

Application	Cfm. per Person (Including Smoking) Recommended	Minimum	Percent of People Assumed Smoking
GENERAL			
Each person not smoking	7½	5	
Each person smoking	30	25	
SPECIFIC			
Apartment	15	10	Some
Banking Space	10	7½	Occasional
Barber Shop	10	7½	Occasional
Beauty Parlor	10	7½	Occasional
Broker's Board Room	30	20	60
Cocktail Bar	20	15	30
Department Store	7½	5	0
Director's Room	30	30	80
Funeral Parlor	10	5	0
Hospital Room	15	10	0
Hotel Room	15	10	Some
Office (General)	15	10	Some
Office (Private)	30	15	50
Restaurant	15	12	25
Shop (Retail)	10	7½	0
Theater	7½	5	0
STRAIGHT VENTILATION			
Hospitals (Ordinary)	40	35	
Hospitals (Epidemic)	80		
Work Shops	25		
Prisons	30		
Theaters	30	20	
Meeting Halls	20		
Schools	30		

Notes on Ventilation

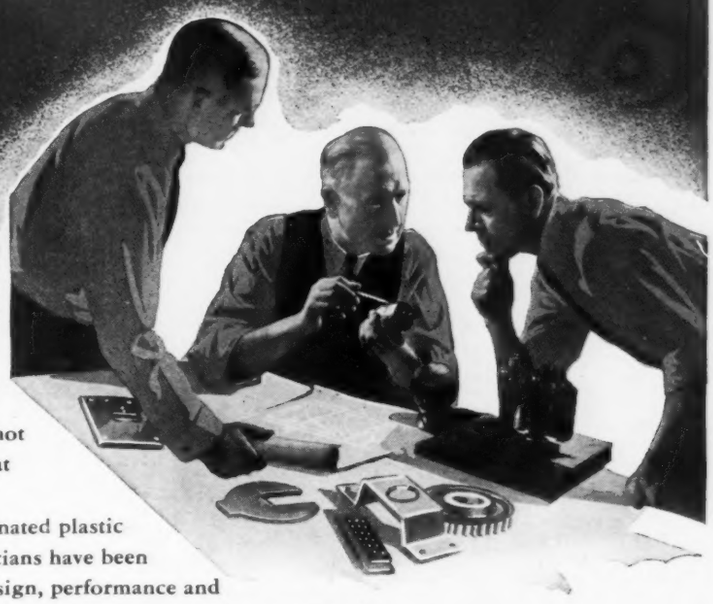
Quantities of air for ventilation have little or nothing to do with supplying an adequate amount of oxygen for normal breathing; they are based upon maintaining a thoroughly clear atmosphere. Where people smoke the quantities are greatly increased (see above).

There is a great difference between the amount of air used for ventilation in a straight ventilating system and the amount of outside air introduced into an air-conditioning system. This is due to the fact that, by maintaining uniform temperature and humidity conditions in an air-conditioning system, much smaller quantities of outside air for ventilation can be used without objectionable odors occurring.

(Adapted from notes of lecture prepared by Bertram B. Reilly, Dravo Corp., Pittsburgh, for presentation to Industrial power salesmen of Duquesne Light Co., Pittsburgh.)

NEW PROBLEMS?

C-D *has acquired the* KNOW-HOW *to help you apply* LAMINATED PLASTICS



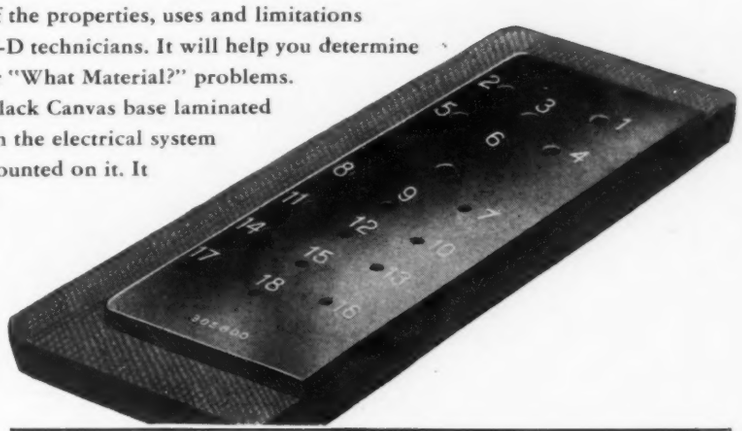
C-D technicians can help you determine whether or not laminated plastics are the answer to your many "What Material?" problems.

C-D produced the first commercially available laminated plastic sheet in 1911. For over a quarter century C-D technicians have been helping manufacturers apply laminated plastics to design, performance and production problems. The KNOW HOW accumulated in the C-D Laboratories covers both World Wars. This valuable store of knowledge of the properties, uses and limitations of laminated plastics is available to you through C-D technicians. It will help you determine where you can use laminated plastics to solve your "What Material?" problems.

The part illustrated herewith is made of C-D's Black Canvas base laminated plastic, DILECTO. It is used as a terminal block in the electrical system of Military Aircraft. Current carrying wires are mounted on it. It must be strong, unaffected by vibration, and must retain its electrical insulating properties under extremes of temperature and moisture. It must also be readily drilled, machined and stamped, and must be dimensionally stable.

The technicians who designed this successful application of DILECTO laminated plastics, are ready to help you with your design and production problems.

Phone, wire or write the nearest C-D office, or send us your blue prints and C-D technicians will get on the job.



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CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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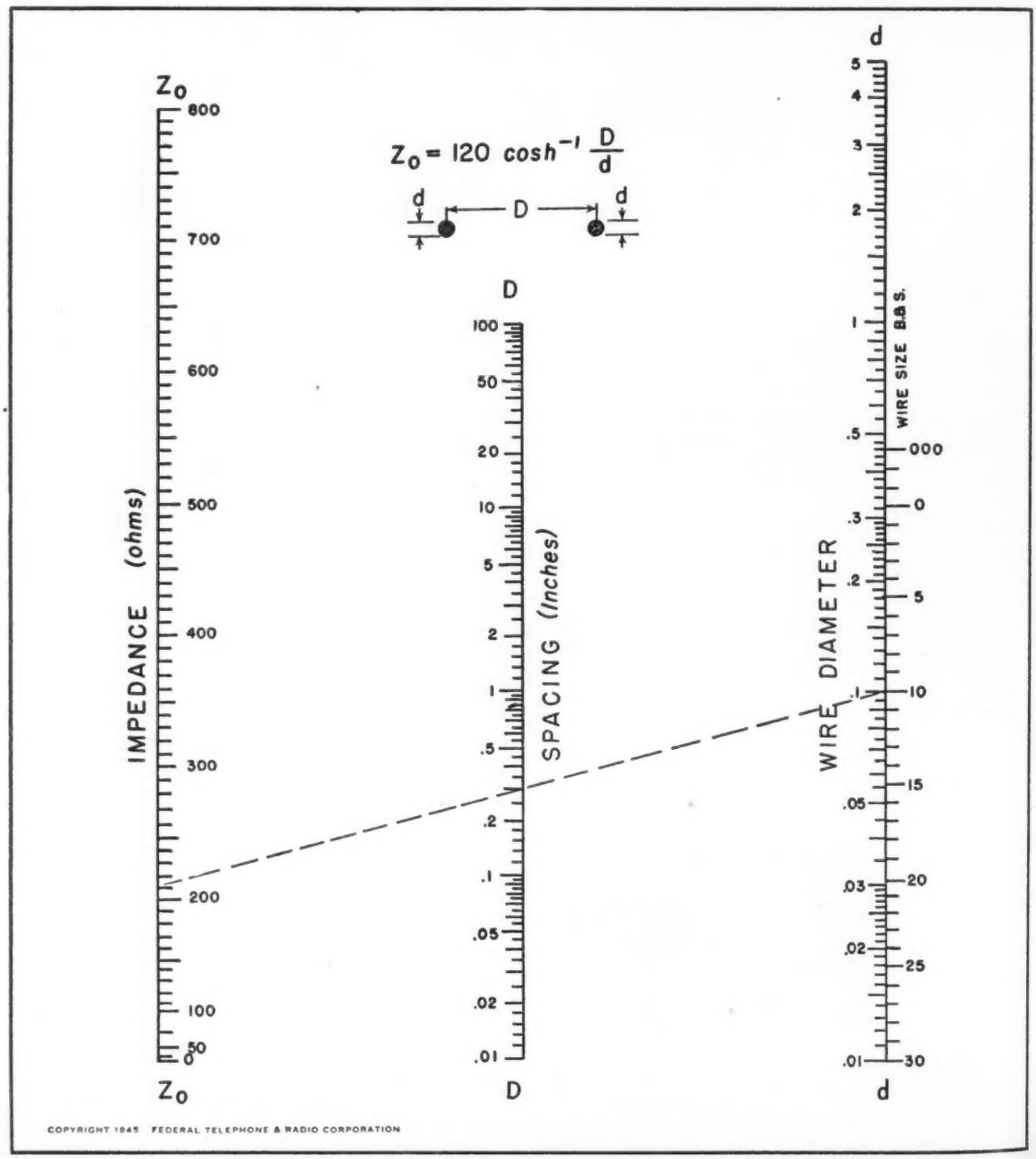
Balanced Two-Wire Line, Air Spaced

N. MARCHAND, Engineer,
Federal Telephone & Radio Corp., New York

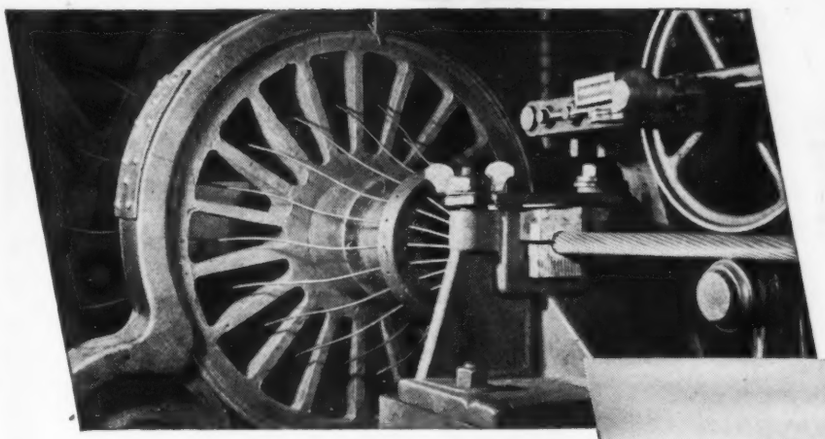


COPYRIGHT 1945 FEDERAL TELEPHONE & RADIO CORPORATION

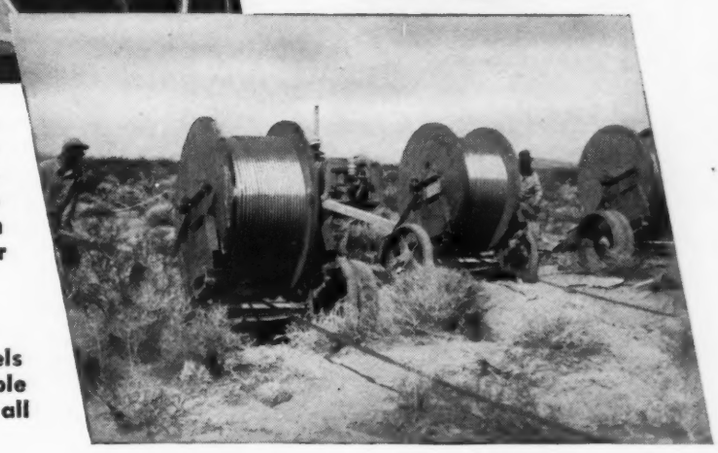
This chart gives theoretical exact values for any scale of dimensions if an air or vacuum dielectric is used with perfect conductors. The lines are assumed to be remote from any conducting plane. Line from d and D scales intersect the Z_0 scale at the resulting value.

Example: d = 0.1 cm. D = 0.3 cm. Z_0 = 210 ohms

Round and round the world stretch more than a million miles of Alcoa A.C.S.R.—proving by the dependable, trouble-free service it has rendered during the past thirty-five years that here's a conductor you can depend on.



Round and round month after month, go the stranding machines in Alcoa's wire mills as they form a seemingly endless number of miles of Aluminum Cable Steel Reinforced—aluminum for high electrical conductivity, steel for high strength.



Round and round go the reels as they pay out mile after mile of cable on rural lines and hi-lines being built all over the country.

For help on engineering your lines, consult Alcoa, makers of Alcoa A.C.S.R. and fittings. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA A-C-S-R

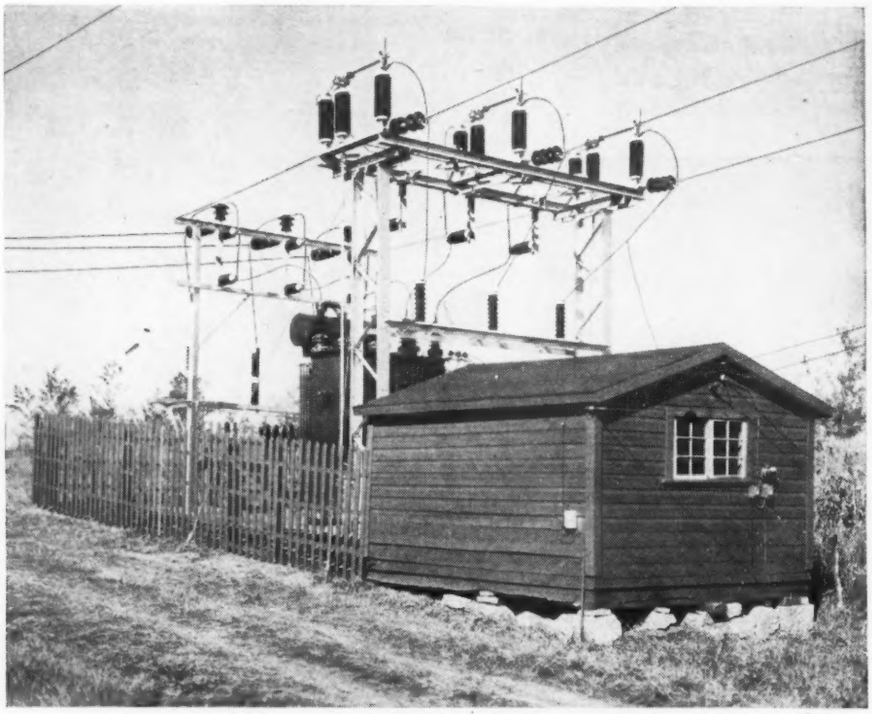
ALUMINUM CABLE STEEL REINFORCED

Airbreak Switch Synchronizes Tie

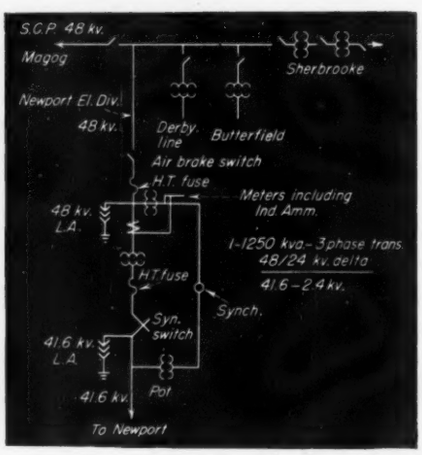
M. G. CLAPPER
Manager
Newport (Vt.) Div., Citizens Utilities Co.

To keep within government regulations limiting the type of construction required to $10,000, the Newport (Vt.) Division of Citizens Utilities Co. recently arranged to synchronize two 48-kv. lines through an airbreak switch, as illustrated. The cost of an oil circuit breaker installation would have exceeded the WPB allowance. The interconnection is between the Southern Canada Power Co. and the Newport division, and is a vital link between private companies and municipalities throughout northern Vermont, including Barton Village, Enosburg Falls, Swanton Village, the Public Electric Light Co. of St. Albans, and the City of Burlington. It provides an outlet for surplus energy from the Province of Quebec and major interconnected utilities and hydro plants there.

The installation has a General Electric forced air-cooled type, HT three-phase, 60-cycle transformer, 1000/1250 kva., with high voltage rating of 48 kv./24 kv. delta and low voltage rating of 41.6 kv. wye, with a 46-kv. neutral bushing on the load side equipped with four 2.5 percent full capacity taps below and two above 41.6 kv., as well as a 2.4-kv., full capacity tertiary winding and high accuracy bushing type current transformers. General Electric furnished low and high voltage lightning arresters. On the low voltage side is installed a Delta Star type MK-39, 69-kv., 600-amp., triple-pole gang operated switch used for synchronizing. On both high and load sides are Delta Star type B-3V, 46-kv. fuse mountings. In five days of early operation, power was purchased to the full capacity of the transformer, and there were five opportunities to synchronize the two systems, which were handled without difficulty or causing any outages on the interconnecting systems.



TRANSFORMER and synchronizing airbreak switching equipment



SINGLE LINE DIAGRAM of connections at tie switching and transformer installation of Citizens Utilities Co.

Flaws Detected by Supersonic Waves

J. W. DICE
Sperry Products, Inc., Hoboken, N. J.

One of the post-war developments which promises savings and increased safety is a non-destructive flaw detector and measuring device called the Supersonic Reflectoscope.

A beam of inaudible sound waves is directed into articles of metal and other materials which might contain defects such as internal cracks, voids or splits. If the beam strikes an internal defect, the instrument registers instantaneously the exact position and relative size of the defect uncovered by this probing beam. Penetration to a depth on the order of ten ft. in materials such as steel or aluminum is easily accomplished.

FIG. 1—Supersonic wave method is used in testing of small steel rotors

When shooting the beam at short distances in materials to be tested, it will accurately pin point and register defects having a diameter measured in thousandths of an inch.

Reflected Vibrations

In introducing high frequency supersonic waves into the material under test, the Reflectoscope is tuned to the desired frequency (from 0.5 to 12 megacycles available). These electrical oscillations are transmitted through a coaxial cable to a quartz scanning unit which the operator moves slowly over the surface of the piece to be tested. The electrical oscillations cause the crystal to vibrate and radiate sound waves in the form of a beam. These sound vibrations are transmitted into the material for durations of only a few microseconds and at intervals of 60 times per second. For the remaining time in each interval, the crystal

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*Based on 1940 N. E. Code

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TRENTON, N J

acts as a receiver, picks up the reflected vibrations and transforms them into electrical impulses which are amplified and impressed on the screen of a 9-in. cathode ray oscilloscope.

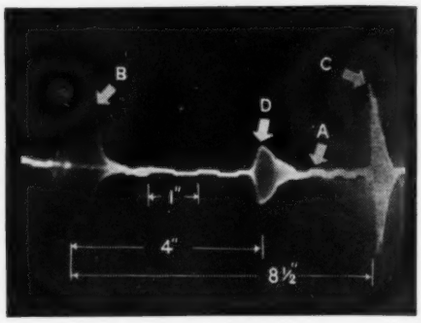

FIG. 2—Typical oscilloscope pattern. "A" is the zero sweep line which may be adjusted so that each full square wave represents any measure of distance from one inch to two feet. "B" is the initial pulse. "C" is the reflected sound wave from the other side of the piece under test. "D" is the reflected wave from a relatively large defect approximately four inches from the surface

In steel, sound travels 20 times as fast as in air or at a rate of four miles per second.

Velocity of propagation of the supersonic waves differs with various materials. Typical examples are:

Steel—229,000 inches per second.
Aluminum—245,000 inches per second.
Brass—174,200 inches per second.
Lead—84,000 inches per second.
Bakelite—102,000 inches per second.
Glass—205,000 inches per second.

Visual Indication

An oscilloscope screen provides a visual indication to the operator whether the material under test is internally perfect or whether flaws are present. This screen has an adjustable scanning line which times the reflected pulses and which can be calibrated in inches, multiples of inches, or feet from the testing surface. A typical oscilloscope pattern is illustrated.

Applications of the Reflectoscope have been made for testing and measuring many manufactured products from raw steel billets, die steel, castings and forgings to finished axles and shafts. It can be successfully used to test such materials as alloys, aluminum, plastics, bi-metals (bonded), ceramics, copper, iron, magnesium, nickel, silver, tin, tungsten, wood, zinc and the precious metals.

Insides of shafts and axles in assem-

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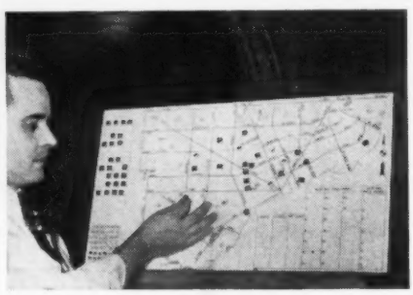
Company .....
Position .....W. 2-2-46

bled equipment such as generators, turbines, compressors and condensers can be "scanned" for dangerous fatigue cracks which would eventually result in a shaft failure. This new supersonic "eye" applied to one end of the shaft can "see" if the internal condition is safe.

•

Magnetic Map Shows Location of Crews

The line crew location board used by the Detroit Edison Co. overhead lines department is notable for two outstanding characteristics: (1) The amount of information it is able to convey to a busy dispatcher about the status, location and type of available line crews and (2) the fact that it is "magnetic."



LINE CREW dispatcher moves crew block to new job location. Crew "blocks" are Alnico magnet blocks that stick to metal-backed map

Made of sheet metal, the location board bears a map of the company's Detroit Division on which color-coded and numbered Alnico magnets, each representing a crew, can be moved at will to show job location, "off-duty," and "stand by" status. It is even possible to show which crews are "out to lunch" and whether the truck's radio equipment is in commission for communication.

Territorial Information

The map also bears the following information:

1. Street and house numbers at intersecting streets corresponding with those on order compartments in dispatch boxes.
2. Warehouse district boundaries.
3. Number and locations of field telephones.

Spaces are provided on the board bearing the names of three warehouses (Maple, Fenkell and Mt. Olivet) and others with the box numbers of east- and west-side field telephones. At its left side is a space marked "off duty" in which crew blocks are placed when crews are not on duty or are not reporting to the line board.

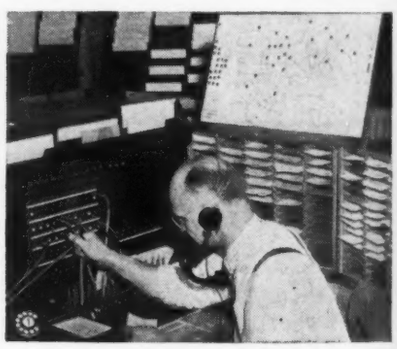
Location of the magnetic crew blocks on the board indicate their status. For example, when a crew is under the control of the dispatcher its block is placed on the map in the vicinity of its work. If it is "standing by" at a warehouse or field telephone, the block is placed in the space for that warehouse or field telephone. Normally the blocks are flat against the board. However, if a crew is "at lunch" its block is turned on edge.

Color Code for Crews

The number of the crew, its type, whether or not it has radio equipment in commission is designated by color code as follows:

Blocks numbered 3 to 49 designate "B" or two-man crews. The "B" crew block has one red face bearing its number in black to designate two-way radio equipment. The opposite face, white with black number, designates a crew without radio or radio out of commission.

Blocks numbered 50 to 79 designate "A" or construction crews and general foremen. Such a block with a white face and green number exposed means no radio transmitter. (General foremen have radio receivers only.) The opposing block face, with green number on red, means the crew is equipped with radio transmitter.



CREW LOCATION board at switchboard dispatchers' position. Street and house numbers at intersections on map correspond with those on compartments on dispatch boxes

Blocks numbered 80 to 97 are reserved for miscellaneous crews. So number blocks with red face and black numerals are two-way radio equipped. The opposite white face with black numerals indicates no radio transmitter.

hiring salesmen...

In the selection and hiring of his salesmen, the appliance retailer takes the first and most important step towards building the kind of business he wants to have. For upon their qualities . . . as men and as salesmen . . . depends in a large measure the success of his enterprise.

That's why this element is given such importance in Kelvinator's comprehensive Vocation-in-Sales Training Program . . . that's why one whole section of the guide "The Selection and Compensation of Retail Appliance Salesmen" is devoted to solid, factual, down-to-earth information and suggestions concerning the selection and hiring of the *right* kind of men. No "textbook theory," all of the subject matter is based on the practical experience of retail sales executives from leading department, furniture, appliance stores and utilities, as well as Kelvinator sales executives, and supplemented by the technical research of outstanding vocational authorities.

Under Chapter 2, "*What to look for in hiring salesmen,*" the following vital subjects are taken up in detail:

1. **WHAT EXPERIENCE IS BEST?**
2. **WHAT EDUCATION SEEMS BEST?**
3. **WHAT DOES EARLY HOME BACKGROUND INDICATE?**
4. **WHAT ARE FAVORABLE SOCIAL FACTORS?**
5. **HOW ABOUT MANNER AND APPEARANCE?**
6. **WHAT MENTAL ABILITIES ARE BEST?**
7. **WHAT PERSONALITY QUALIFICATIONS SHOULD YOU LOOK FOR?**

Here is "brass-tack" thinking . . . an important retail-minded contribution to sales management methods, which is based on the facts revealed by Kelvinator's famed Retail Sales Management Forum.

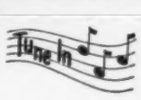
In every one of its other phases too, Kelvinator's great V. I. S. Program is retail-minded . . . because every phase grows out of a distinctively Kelvinator way of doing business that makes the Kelvinator Franchise . . .

The most Valuable Franchise in the Appliance Industry

RETAIL-MINDED

Kelvinator

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

Tune in **N-K MUSICAL SHOWROOM** Nash - Kelvinator's new hit musical show, with the Andrews Sisters, Curt Massey and Guest Stars—every Wednesday evening at 10:30 P.M., E.S.T.—Columbia Broadcasting System.

LOAD BUILDING

Commercial
Industrial

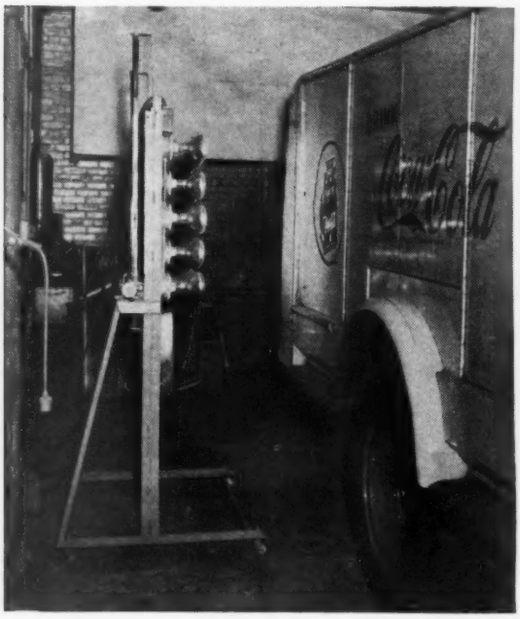
Residential
Rural

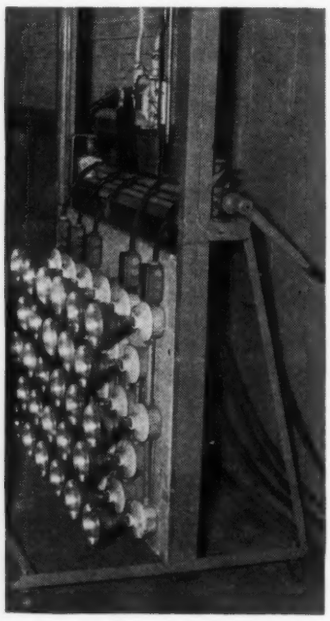
Infrared Unit Speeds Beverage Carrier Drying

Preliminary application of infrared electric heating at the Brighton (Mass.) plant of Coca Cola Bottling Co. of Boston has insured a striking reduction in drying times in comparison with air drying. The company made up a portable infrared unit containing 28 R-40, 250-watt lamps to facilitate application to varied jobs such as decalcomania illustrations on the sides of delivery trucks, signs and dispensing cabinets. The lamps were mounted on 7-in. equilateral triangular spacing, with bases on an insulated backboard carried on an adjustable rack and pinion with framing of steel members to enable the lamps to be run up and down to fit different jobs, with provision for latching in place at desired heights when cranked to position. Five circuits, each controlled from a snap switch on the shop wall, serve the lamp bank via flexible cables, central station energy being purchased for the work. Half-inch conduit was used on the lamp panel, and the framing was composed principally of 1½-in. steel angles.

A typical job covers carton drying on a truck side. This takes about 20 minutes per period for each of three colors: red, green and maroon, the lamp bank being 24 to 36 inches away from the truck face. With air drying, before infrared was employed, each color consumed from 12 to 24 hours, giving a total drying period of from 36 to 72 hours per carton.

Two other applications: In drying a cab sign of wood, nine lamps were switched on 16½ inches from the painted surface, the paint being flowed on heavily with a brush. Time required was 14 minutes, or 10 minutes with lamps 12½ inches from the work. A cab sign of wood sprayed with 20 percent special thinner in the paint mixture dried in 13 minutes with lamps 9 inches distant.





PORTABLE LAMP BANK totaling 7 kw., with five circuit subdivisions to fill working requirements, dries truck cartons in hours against days by the former air exposure method. Close-up of portable infrared lamp bank at right

Ever New Appliances in Pennsylvania Schools

Electrical appliances used in homemaking courses in the public schools of William Penn's state are never going to become rackety and out of date—not if local school authorities follow the advice contained in "Planning the Homemaking Department" which is Bulletin 324 of the Department of Public Instruction, Commonwealth of Pennsylvania.

Under the heading, "Plan a Replacement Program," is the following instruction:

"It can be said truly that a plan for a homemaking department is of little value without a practical program for replacing mechanical and other equipment and furnishings. Probably the greatest mistake that can be made is for a school to purchase an array of modern appliances—ranges, refrigerators, washers, and clothes driers,—only to find that these homemaking devices are obsolete five years later. This need not be a serious problem if a replacement program is carefully considered at the time of purchase. Let us consider a workable arrangement for appliances that has proved satisfactory in more than one instance. For example, let us assume that a school needs a range and selects one at a selling price of $150. At a regular price to schools this range might be purchased for, let us assume, $90. This is $60 below the regular market price.

Replacement Plan

"This range is then used by the school for one year, and one year only. At the end of that period the school automatically sells the range as "used" merchandise for $90 (the school cost of the range). Ordinarily there is no trouble in disposing of a "used" appliance at prices similar to that indicated above. In fact, some schools have a "waiting list" of people who wish to purchase this kind of merchandise.

"The range is then replaced with a new one of a similar type (at approximately $90), and the school then continues to follow this procedure over a period of years without adding to the original investment.

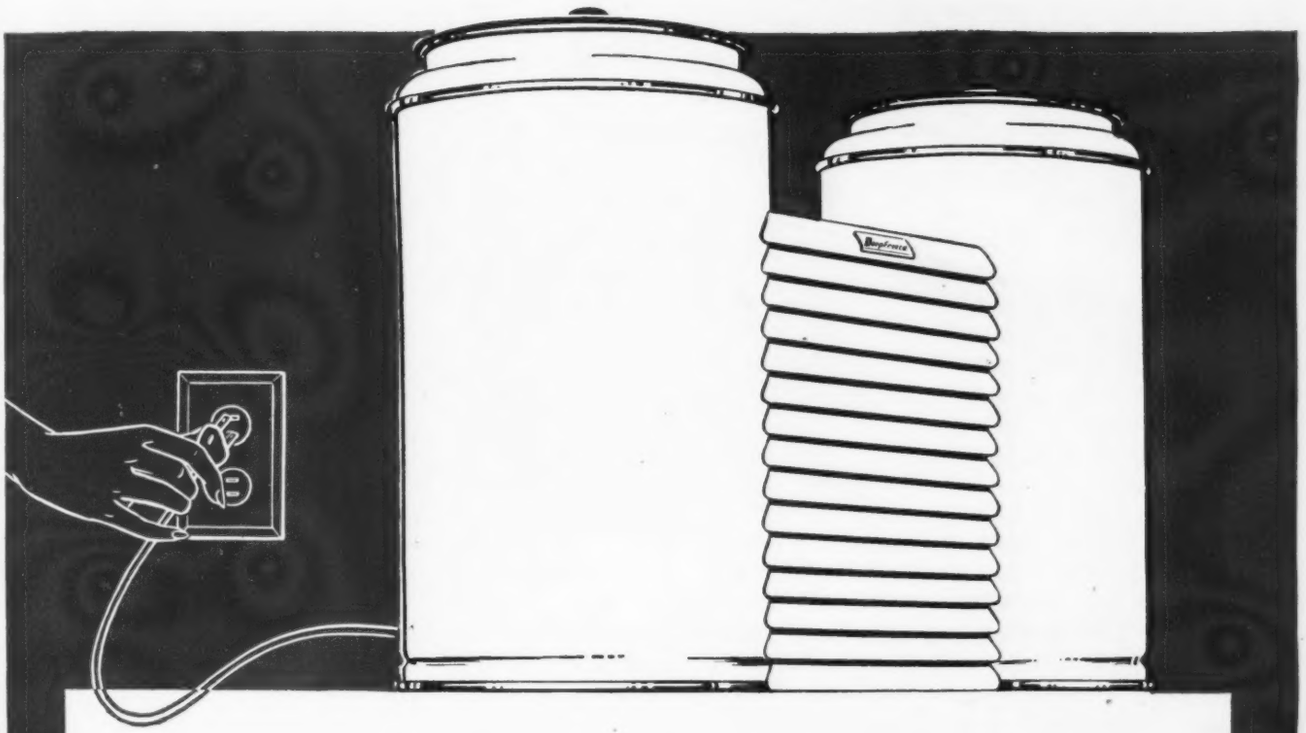
"In other words, a replacement program of this kind accomplishes two important factors. First, it provides a means of replacing old appliances with

Deepfreeze

TRADE-MARK REG. U. S. PAT. OFF.

the talked-about home freezer

Opens New Load-Building Opportunities



When one of your customers plugs in a home freezer it's plugged in "to stay." The need for power continues right around the clock, every day of the year. Power consumption of the family-size home freezer is greater than that of a home electric refrigerator.

It's all plus business—in every community—rural or urban.

The home freezer is entirely new—competing with neither the electric refrigerator nor the food locker.

The swing to frozen foods and home freezing is as big as America—it's here to stay—and it's on now.

* * *

DEEPFREEZE is by far the leader in home freezers. It is the one home freezer with already proved dependability. Thousands are in happy service today.

Get behind Deepfreeze—a sure new source of revenue. It will pay you.

DEEPFREEZE DIVISION • MOTOR PRODUCTS CORPORATION • NORTH CHICAGO, ILLINOIS

For the first time in over four years we are now able to quote immediate delivery on U. S.-made hand-cranked "Megger" Insulation Testers.

Not until war came did anyone realize the tremendous number of insulation testers that were going to be needed, nor what a vital place "Megger" instruments were to have in the picture. Now that our Philadelphia factory has been in full production for nearly three years, these heavy demands have been met, and we can again invite orders from both old and new customers alike. We take pride in being able to offer the same rugged and dependable "Megger" instruments in various ranges up to 2000 megohms and with hand-cranked d-c generators up to 1000 volts. We continue to supply other types and ratings of "Megger" instruments as formerly.

If you are uncertain which type and range of insulation tester is best for your particular needs, write us, telling the type, size and rating of your equipment. We will gladly make recommendations. Also ask for illustrated Bulletin 1735-W.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

Insulation Testers, Ground Testers, and Ohmmeters

JAMES G. BIDDLE COMPANY

1211-13 Arch Street • Philadelphia 7, Penna.

new and modern equipment without material additions to the original investment. Second, it practically eliminates the problem of obsolescent equipment in respect to those items that lend themselves to such a program. It is no longer necessary to face an entirely new modernization problem every five, ten or fifteen years.

"Such a replacement plan for most appliances can be followed without any complications or inconvenience, provided that it is handled systematically. In cases where schools, for policy reasons, do not desire to sell second-hand merchandise, they can usually arrange for replacements through their dealers or local utility companies."

•

Energy Consumption Of Farm Equipment

Average kilowatt-hour consumption of typical farmstead electrical equipment in the accompanying table, based on REA data and published by Westinghouse Electric Corp., has been incorporated in the Farm Electric Service Handbook prepared by Northern States Power Co., Minneapolis, for the reference of its rural electric service customers.

ON THE FARM	KW.-HR. CONSUMPTION
Barn Ventilator	2½ per cow per month (variable)
Bottle Washer	½ per 1,000 bottles
Brooder	½ to 3 per chick raised
Churn	1½ per 100 lb. of butter
Clipper (for horse or cow)	1/10 per hr.
Concrete Mixer	½ per cu. yd. of concrete
Corn Husker-Shredder	30 per 100 bu. of corn husked
Cream Separator	½ per 1,000 lb. of milk
Dairy Water Heater	1 per 5 gal. of hot water (145 deg. F.)
Ensilage Cutter	1 per ton
Electric Fence	7 per month
Fly Screen or Trap	5 per month
Grain Elevator	4 per 1,000 bu.
Grain Grinder	½ per 100 lb.
Grain, Seed Cleaner and Grader	1 per 100 bu.
Green Feed Cutter and Beet Shredder	2 per ton
Hay Baler	2½ per ton
Hay Hoist	⅛ per ton
Hotbed	1 per sq. yd. per day
Incubator	1 per 25 eggs set

(Table continued on page 110)

Guth FLUORESCENT

KEYED FOR THE SPECIFIC LIGHTING JOB!

Proofs of GUTH "Know-How" Lighting in the Transportation Industry

Original fixture design by ELEC. DEPT. of B. & O.R.R.— final design by Edwin F. Guth Co.

Guth FLUORESCENT Perfect Reading Light

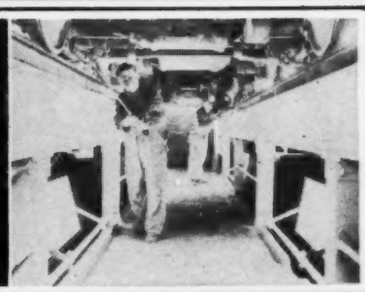
GUTH Fluorescent is "keyed" for the specific lighting job. To the left, for example, is the Waiting Room of the Washington, D. C. Union Terminal. Here, with GUTH Fluorescent, a person can wait and read in comfort, as there is no glare —just pleasant, shadowless "seeing light" directed over his shoulder onto his newspaper or magazine.

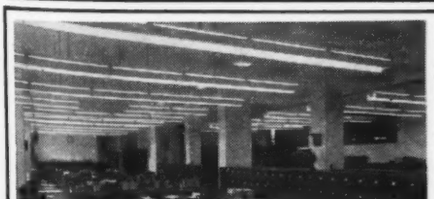
SOLUTION: GUTH Fluorescent is mounted continuously atop settees. Single forty-watt lamps, continuous, are used; fixtures are well-louvred to cut off all glare from facing seats. Eighteen foot-candles were measured on the reading plane.

Guth FLUORESCENT Inspection Lighting

Every business has lighting problems peculiar to itself, Inspection Pits in the Transportation Industry, for example. Here, as elsewhere, GUTH Fluorescent provides the efficient solution. Ruggedly constructed to withstand long, hard usage. The "Before-and-After" photos at the right clearly show the improved seeing and working conditions resulting from "keyed" GUTH Fluorescent.

GUTH FLUOFLECTORS deliver 50 foot-candles at the working area. QUICKLITER ballasts supplied with these GUTH Units give reliable operation even at winter temperatures. Lamps are enclosed; protected against dirt and grease.





Guth FLUORESCENT Office Lighting

This large railroad office uses GUTH Fluorescent to produce 60 foot-candles of comfortable, proper lighting on desks and working areas. In addition, the planned design of GUTH Fluorescent affords low maintenance costs.

Guth FLUORESCENT General Lighting

At right are "Before-and-After" lighting photos of the Portland, Maine Union Station. A completely new atmosphere has been created with GUTH Fluorescent.

GUTH FUTURLITERS on 12' 0" spacing and 12' 0" mounting, provide 40 foot-candles on ticket counters, and 30 foot-candles through balance of area.

2615 WASHINGTON AVE. **THE EDWIN F. GUTH CO.** ST. LOUIS 3, MISSOURI

LEADERS IN LIGHTING SINCE 1902

The NEW Sales Story
for WATER HEATERS
SMITHway Permaglas Water Heaters . . . lined with Permaglas . . . give you the most dramatic, new sales story in the appliance business!
1 The monotrial glass-lined tank is lined with Permaglas, the sparkling blue, mirror-smooth glass fused-to-steel.
2 Sanitary as a sparkling drinking glass . . . for Permaglas has been tested with waters from every state in the Union.
3 Freedom from all tank rusting and corroding. Permaglas CANNOT rust or corrode under any and all water conditions.
4 No tank-corrosion in the hot water . . . no "tank specks" on clean clothes.
5 Hot water as sparkling clean as its source!
There's Only ONE PERMAGLAS
SMITHway Permaglas
GLASS-FUSED-TO-STEEL
TRADE MARK REG. U. S. PAT. OFF.
A GREAT AID TO SALES
A total of 23,000 test-years went into the perfecting of this truly modern water heater . . . the heater that "packages" hot water in glass! Don't wait another day before you get the full details on Permaglas and all the other advanced features of the SMITHway Permaglas Water Heater. Send for the revealing booklet, "The Inside Story of Permaglas."
HOT WATER BY wire
A. O. SMITH Corporation
SMITHway Permaglas
GLASS-FUSED-TO-STEEL
ELECTRIC WATER HEATERS

Irrigation (surface)	3 to raise an acre-ft. of water 1 ft.
Milking Machine (portable)	1½ per cow per month
Milking Machine (pipe line)	2½ per cow per month
Milk Cooler	30 per 10 gal. milk daily, per month
Paint Sprayer	1½ per 1,000 sq. ft.
Poultry House Lighting	6 per 100 birds per month
Poultry Water Warmer	1 per day
Sheep Shearer	2 to shear 100 sheep

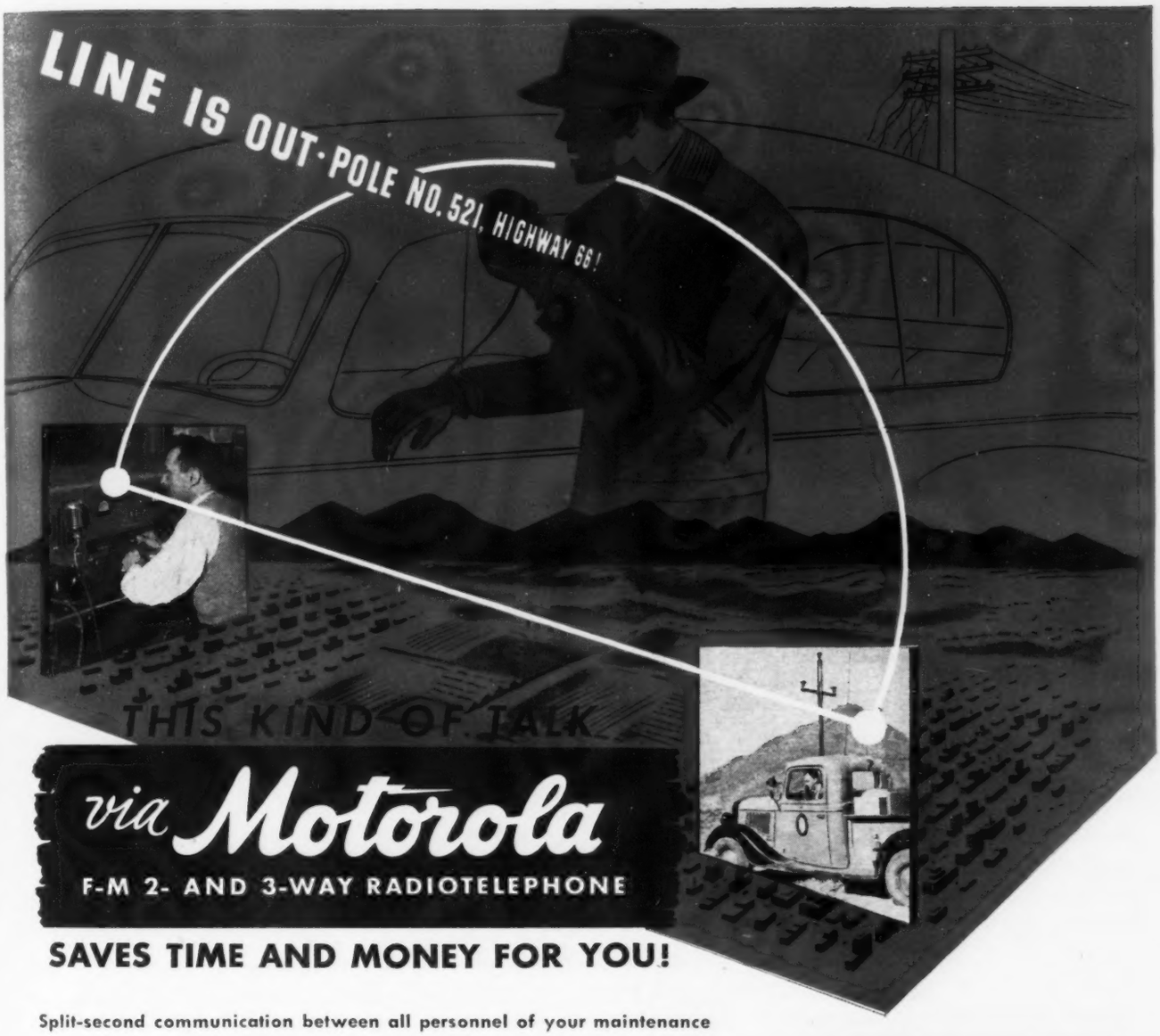
ON THE FARM	KW.-HR. CONSUMPTION
Straw Cutter	2 per ton
Threshing Machine	1 per 8 bu. of grain
Tool Grinder	½ per hr. of use
Ultraviolet Lights for Poultry	10 per 100 hens per month
Utility Motor, Small ¼ hp.	½ per hr. of use
Utility Motor, 3 and 5 hp.	1 per hp. per hr. of use
Water Pump (deep well)	1½ per 1,000 gal.
Water Pump (shallow well)	1 per 1,000 gal.
Wood Saw	2 per cord of wood

IN THE HOME	KW.-HR. CONSUMPTION
Clock	2 per month
Coffee Percolator	5 per month
Curling Iron	½ per month
Dishwasher	2½ per month
Fan (household)	2 per month
Fan (kitchen)	8 per month
Freezer	125 per month
Heater (glowing or radiant)	1 per hr. of use
Heating Pad	½ per hr. of use
House Heating (oil burner)	25 per month
Iron (hand)	5 per month
Ironing Machine	10 per month
Lighting	20 per month
Radio	8 per month
Range	120 per month
Refrigerator	35 per month
Sewing Machine	½ per month
Toaster	3 per month
Vacuum Cleaner	2 per month
Waffle Iron	2 per month
Washing Machine	3 per month
Water Heater	240 per month

How Lighting Engineers Can Aid Customers

Better lighting automatically increases manpower efficiency and, according to data available, the normal expectation is an increase of 12 to 15 percent, but much greater gains are sometimes achieved.

A trained lighting engineer may be

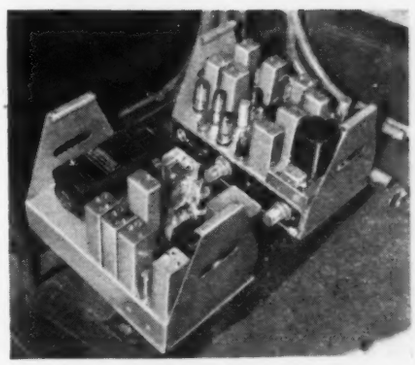


SAVES TIME AND MONEY FOR YOU!

Split-second communication between all personnel of your maintenance department means greatly increased efficiency throughout your entire system. No time is lost by repair crews waiting for instructions by telephone, or in reporting back between jobs. Fewer Patrol cars and repair cars are necessary when their efficiency is increased with Motorola Radiotelephone. So the initial cost of the equipment is quickly balanced by the savings in time and maintenance.

WHEN YOU DECIDE ON RADIOTELEPHONE—CHOOSE MOTOROLA!

Motorola dependability has been *proved* time and again! The California Electric Power Co. uses Motorola equipment exclusively for line patrolling. Police of 34 states and over 1,000 communities rely on Motorola for emergency communications. Ask us to submit specific recommendations on the application of Motorola Radiotelephone in *your* system. There's no obligation, of course—WRITE TODAY!



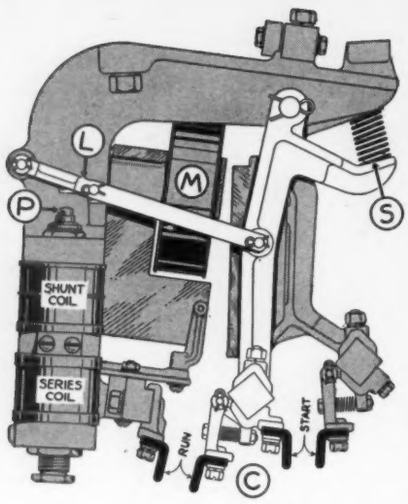
One of the many types of Motorola mobile units for use in patrol cars, repair cars, etc. (Shown with dust covers removed.)

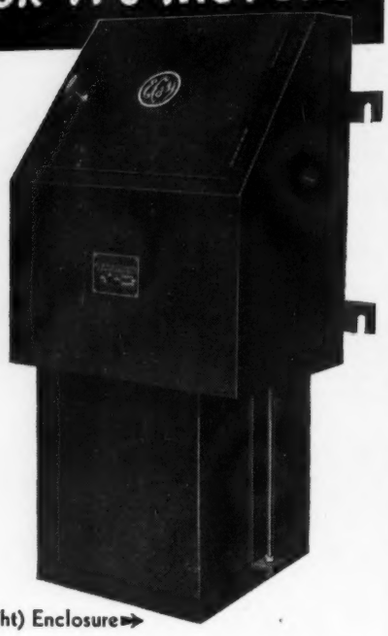
GALVIN MFG. CORPORATION • CHICAGO 51

COMMUNICATIONS AND ELECTRONICS DIVISION

F-M & A-M HOME RADIO • AUTO RADIO • PHONOGRAPHS • TELEVISION • "HANDIE TALKIES" • POLICE RADIO • RADAR • MILITARY RADIO

HEAVY DUTY, PUSH BUTTON STARTERS FOR A-C MOTORS





Standard (Semi-Dust-tight) Enclosure➡

For reduced voltage starting of 220-550 volt squirrel-cage motors these EC&M auto-transformer starters have a reputation for low up-keep cost throughout industry.

As illustrated above, the mechanism is a single, quick-break, double-throw Contactor (C), operated by a single Magnet (M), a throw-over Spring (S) and a mechanical Latch (L) tripped by plunger (P) which is raised by a current-limit relay to cause transition from reduced voltage starting to full voltage running.

Arranged for wall mounting with contactor oil-immersed in removable tank, the auto-transformers and thermal Overload Relays are mounted in the upper part of the case. Unlike conventional thermal relays, this device is of the hot-wire expansion type. It is set to trip at a low value of current above normal full load motor current for accurate overload protection. This can be done without false tripping during the starting period, because the wire is protected from high starting currents by current transformers.

Bulletin 1045-B gives complete ratings and dimensions and also lists three larger sizes of starters for 220-550 volt motors. Write for your copy.

⬅Type VIII Enclosure for Class 1, Group D Hazardous Locations

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

handicapped in making recommendations because of the difficulty to obtain new lighting equipment. But if the system has not been recently engineered he can ordinarily find ways to make quick, easy, inexpensive improvements that will help the utility company's customers get more manpower from existing personnel. An outline for this purpose is reproduced from a circular of the National Electrical Manufacturers Association.

Here are some of the things to do:

1. Check foot-candles throughout the plant and especially at work surfaces.
2. Recommend paint for walls, ceilings, floors and other surfaces.
3. Make up schedules for cleaning lighting equipment and windows.
4. Specify the proper cleanser for each use.
5. Suggest labor-saving methods for reaching or for handling equipment to be cleaned.
6. Advise on availability of labor-saving devices.
7. Make load and voltage checks of the electrical distribution system, plus a schedule for subsequent testing.
8. Check stocks of spare parts and recommend minimum and maximum for each item.

•

Gimbels Store Traffic Increased by Television

"Shopping by Television" experiment conducted in Gimbel Bros. department store in Philadelphia recently allowed the RCA-Victor research department to obtain the customer's reaction to the new use of the medium as a "puller."

Approximately 2,375 persons were interviewed and the tabulation of replies reveal that:

1. The majority indicated by a "yes" or "maybe" that they intended visiting the department whose merchandise was shown by the store television.
2. Sixty-three (72.7) percent of those interviewed stated that "shop-by-television" was one of the features that attracted them to the store.
3. Eighty-nine (88.9) percent of the respondents consider store television an aid to shopping.
4. Seventy (69.9) percent indicated that this was the first time that they had seen television.

From the above, it is apparent that "shop-by-television" can be used effectively to pull traffic into a department.

New ALL STEEL SCREW ANCHOR

DROP FORGED TRIPLEYE ROD
HIGH STRENGTH STEEL HEAVILY GALVANIZED
ROD and HELIX DOUBLE WELDED TOGETHER • SMALL HUB
HELIX CORRECTLY PITCHED and TAPERED

Easier to Install·· More Holding Power

Here is the latest improvement in the all-steel screw anchor—a drop forged steel tripleye rod, *double arc welded to a forged steel blade. This new anchor has been given "the works" in field and laboratory tests. It has topped our most optimistic expectations. Under ideal conditions, this anchor—in all sizes—has been tested to pull several times its rated holding power. We attribute its great strength to the fact that both anchor and rod are forged steel, *double welded together, with the blade being correctly pitched and tapered for minimum earth disturbance and the hub small to allow a greater holding surface.

The forged tripleye on the rod is large enough to admit a bar for use as a wrench in screwing down. It will accommodate one, two, or three guy strands. The SAE 1040 forged steel rod has a higher carbon content than other types of anchor rods and will not yield to torque during installation. Both rod and helix are heavily galvanized before the helix is dipped in asphaltum paint.

The pitch of this new anchor helix is not limited by the manufacturing process. By forming the rod and helix separately and welding them together, it is possible to control the pitch of the blade or helix, on every size anchor, to the exact degree required for best installation and holding power.

The steel blade or helix is tapered to the outer edge and sharpened to reduce friction and make installation easier. The small hub allows more holding area and minimizes earth disturbance, thus aiding installation.

Screw Anchors are made in 4, 6, 8, and 10 inch sizes and are recommended for installation in sandy soils.

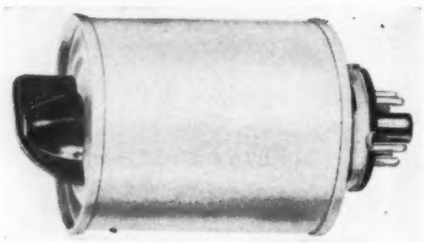
**Blade is welded to rod on both top and bottom sides with shielded arc electric weld.*

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

NEW EQUIPMENT

Interrupter



Self-timing interrupter: timing range, 1 to 12 pulses per second; voltage, to 32 volts d.c. and 125 volts a.c.; contact rating, 10 amp., non-inductive; contacts, SPST (NO or NC-double break), DPST (NO or NC), and DPDT. **Electronic Controls Inc.**, 44 Summer Ave., Newark 4, N. J.

Interrupter is comprised of a glass-enclosed thermal element of the hot-wire type, a small power relay and a resistor (when required) to apportion properly the flow of current between the thermal element and the relay coil. The device is made with a fixed, predetermined rate of interruption or with an external variable adjustment. The fixed unit is made in both open frame construction and in plug-in metal enclosures—dust covered or hermetically sealed; the adjustable unit is made in plug-in dust cover enclosures only.

•

Wheatstone Bridge

Portable Wheatstone Bridge: accuracy 0.1 percent from 1 to 40,000 ohms; single dial ratio selector; self-wiping switches; snap-lock dial position; three sensitivity ranges; resistance, Murray, Varley, Hilborn, 3 Wire Varley and Fisher test loops. **Wilson Co.**, 9 Liberty St., Newark 5, N. J.

Bridge has enclosed contacts and is designed for laboratory, production or communication usage. The limit of error for the ratio resistors is reported as 0.05 percent. Ratios of 1/1,000, 1/100, 1/10, 1/9, 1/4, 1/1, 10/1, and 100/1 are available. Additional ratios of M/1,000, M/100 and M/10 are provided for looping line faults. A cam switch with three positions sets the bridge for the various loop tests. The galvanometer is a replaceable unit with a clamp lock, has a coil resistance of 250 ohms, uses soft iron pole pieces, and has a sensitivity of 1 microampere per scale division deflection. Three push buttons select sensitivity ranges of 0.01, 0.1 and 1.0. The switches are wired to protect the galvanometer against switching surges.

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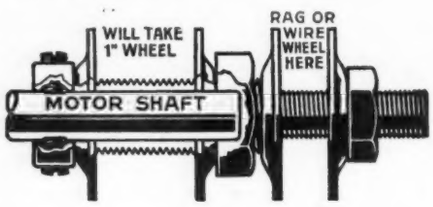
Attachment Arbor

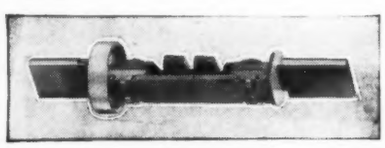


Combination attachment arbor for ½-in. electric motor shaft. **A. D. McBurney**, 939 W. Sixth St., Los Angeles, Calif.

Combination attachment arbor is designed to take grinding wheels with ¾-in. holes on the main shaft, or ½-in. holes on the small ends. The extension can be used for rag or wire wheels or for circular saw blades. The extension also holds ½-in. 24-thread drill chucks. The unit fits over and onto the main motor shaft and is reported to eliminate "whipping."

•

Fuses



Renewable fuses. **Jefferson Electric Co.**, Bellwood, Ill.

New method of construction is said to overcome difficulties arising from varying degrees of contraction and expansion between the fuse barrel and the link assembly. Link assembly is reported to avoid unbalanced strains and possible buckling and thereby hold knife blades in initial alignment.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

•

Indicator

Approach angle indicator for airport landing. **Westinghouse Electric Corp.**, P. O. 868, Pittsburgh 30, Pa.

An angle indicator, which projects a tricolor beam which indicates the correct angle of approach for planes, sends the light through seven lenses, breaking it up into green, red and amber beams. The green indicates the correct angle of approach; the red, or lowest layer, warns that the approach is being made too low; and the yellow, or highest beam, indicates the plane is too high. The beams are controlled by a motor driven shutter—flashing on for one second and off for one-half second. Beams are said to be visible for one mile when 100-watt incandescent lamp is used and for three miles with a 250-watt lamp.

•

Sunlamp

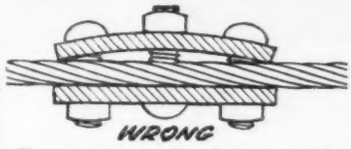
"Selector," model "S-200" sunlamp; adjustable to a height of 80½ in. **Sperti, Inc.**, 424 E. Fourth St., Cincinnati, Ohio.

Sunlamp is reported to be selective in projection of either ultraviolet or infrared rays, or a combination of both. The lamp is of the triple reflector type containing two infrared

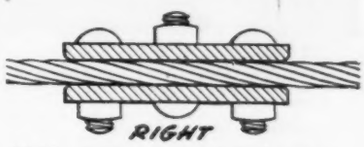
WHY?

DO HUBBARD STRAIGHT GROOVE GUY CLAMPS HOLD BEST?

1. **Because:** The **straight groove** eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand.



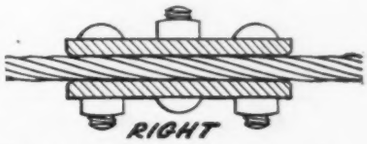
Clamping area reduced by warped section. Causes slippage at low strains.



Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

2. **Because:** The **straight groove** fits any and all twists, right or left hand and a variation in diameter without **creating** any high spots to **lessen clamping area.**

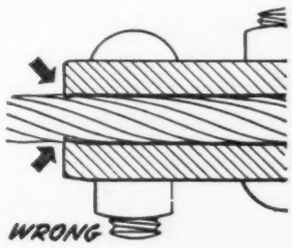
High spots in clamp reduce clamping area, cause slippage and injure strands.



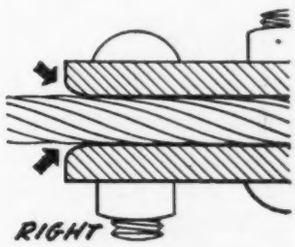
Hubbard Clamps fit snugly over any and all twists, right or left and variations of diameter.

3. **Because:** Bell-end grooves prevent injury to the strand.

4. **Because:** High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used — HUBBARD DOUBLE-DIP HOT GALVANIZING.



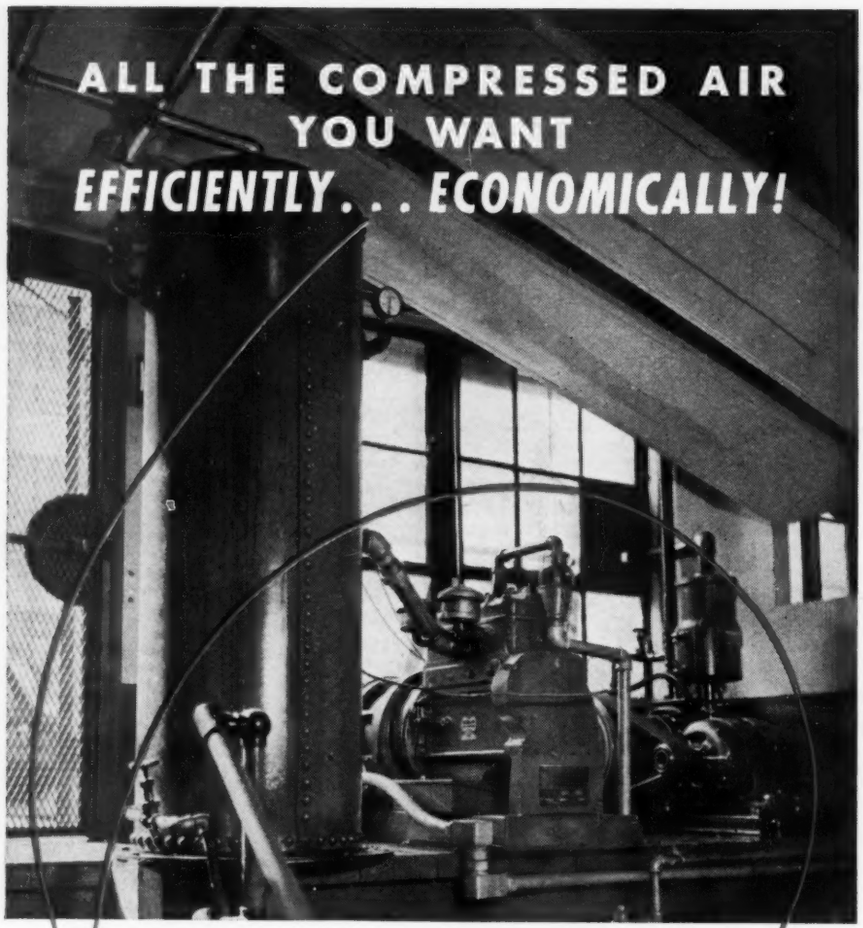
Sharp edge from sheared section injures and weakens the guy at end of clamp.



Rounded ends of Hubbard Clamp sections protect strand.

HUBBARD and COMPANY

Pittsburgh Oakland, Calif Chicago



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burners on each side of an ultraviolet generator. It operates on either a.c. or d.c. circuits and has a universal adjustment to direct the rays where desired.

TECHNICAL LITERATURE

Shunt Capacitor Standards—NEMA publication 45-100 provides practical information concerning construction, test, performance and manufacture of shunt capacitors. Copies may be obtained from National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y., for 75 cents each.

Arrester Standards—Publication 45-95, "NEMA Standards for Expulsion-Type Distribution Lightning Arresters," is a supplement to publication No. 44-89. It contains the general, rating, manufacturing and testing standards, test and test procedures, insulation tests and tests on completely assembled arresters. Copies may be secured from National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y., for 75 cents each.

Industrial Control—Publication No. 45-95, "NEMA Standards for Industrial Control," contains those standards of equipment which, individually or grouped, served to govern in some predetermined manner the electric power delivered to the apparatus to which they are connected. This equipment includes contactors, drum switches, photoelectric relays, autotransformers, reactors, rheostats, relays, timing devices, resistors, switch devices, dimmers and electronic regulators. Also included are standards for solenoids, electro-magnetic brakes, electronic follow-up and positioning controls, and electronic inspection and gaging apparatus. Copies may be obtained from National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y., for $1.50 per copy.

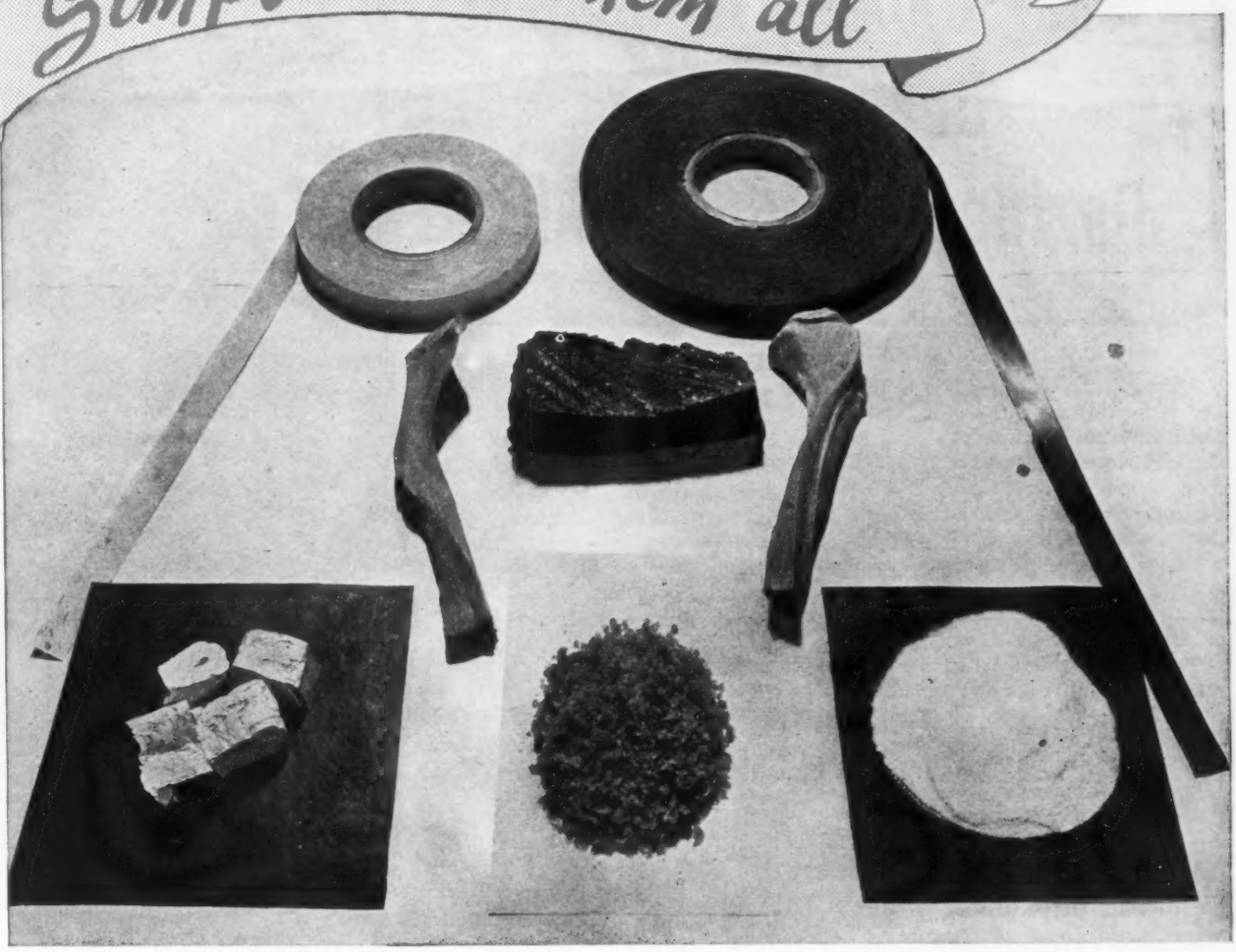
Rotating Equipment Standards—Publication 45-102, "NEMA Motor and Generator Standards," covers standard on such equipment as small and large a.c. and d.c., single and polyphase motors, a.c. and d.c. elevator motors, crane motors, generators of both a.c. and d.c. types, frequency converters and motor-generator sets. Copies are available at $4.00 each from National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y.

Welding—Part A—Arc Welding of Steel 3/16 to ¾ in. thick of the American Welding Society's Code of Minimum Requirements for Instruction of Welding Operators has been revised to meet postwar requirements. Among the topics covered are design of positioning equipment, design and use of testing equipment, welding electrodes, and suggested exercises. Copies are available from American Welding Society, 33 W. 39th St., New York 18, N. Y., for 50 cents each.

Cooler Standards—Commercial Standard CS127-45, "Self-Contained Mechanically Refrigerated Drinking Water Coolers," is a voluntary standard of the trade on that type of equipment. The purpose of the standard is to establish uniform methods of testing, rating, and designating capacity of the coolers, and to recommend normal standard size designations. Copies may be received from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., for 10 cents each.

Home Freezer Standards—Publication No. 45-106, "NEMA Home Freezer Standards," is released to provide a uniform procedure for determining the performance of mechanically operated home freezers under specified laboratory test conditions. Copies are available from National Electrical Manufacturers Association, 155 E. 44th St., New York, 17, N. Y., for 25 cents each.

Simplex uses them all



Whether it's the good old stand-by insulations, like varnished cambric or paper, or the very newest, such as polyethylene or silicone rubber, Simplex uses all of them in the places for which they are best adapted. Because Simplex has had wide experience with most of these insulations, it is thoroughly qualified to advise you on the engineering problems peculiar to cable construction and cable uses.

When you need a cable that has to meet extraordinary conditions, you can depend upon Simplex research and engineering to provide the best cable for you that the state of the art will permit. There is no leaning toward one material or the other. All insulations have some uses. Only a qualified cable engineer backed by years of experience can tell you whether one or the other kind of insulation is best for the job you propose to do.

Remember, the best things in cable materials and constructions come from Simplex first.

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What 0.04% Phosphorus Does To Your Dezincification Problem

Plain Admiralty Metal has almost all the properties for successful condenser and heat exchanger tube service that are needed to meet many power plant and oil refinery applications . . . but it has one weakness — fair to poor resistance to dezincification.

Under certain conditions, its brass content is gradually replaced by a spongy, porous copper deposit, locally (plug type) or uniformly over the tube (layer type).

To overcome this problem . . . and still retain the high corrosion resistance of plain Admiralty . . . Scovill *Service in Metals* developed Phosphorized Admiralty*. This is the alloy that Scovill engineers are recommending for many types of power plant and oil refinery service where dezincification of plain Admiralty has been observed or anticipated.

Many Times Greater Life

By inhibiting dezincification, Phosphorized Admiralty offers much longer service life. This improvement is brought about by a very slight change in the alloy composition — the addition of approximately 0.04% phosphorus. There is no appreciable difference in the structure or mechanical properties between regular and Phosphorized Admiralty as shown by the photomicrographs and graph at the right. There is no impairment of the metallurgical, physical and otherwise excellent corrosion-resistant properties.

Experience of Scovill customers has shown that in cases where dezincification has been troublesome, a change to Phosphorized Admiralty extends service life.

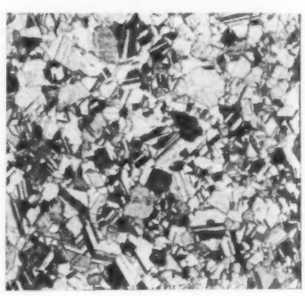
*"Phosphorized Admiralty Tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by Scovill Manufacturing Company, the owner of this patent.

Other Scovill Services

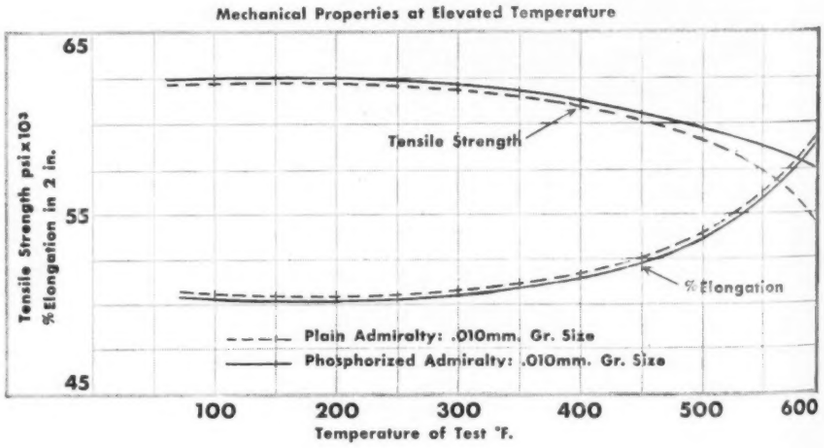
Service in Metals, which includes the development of new alloys to meet changing service conditions and also individual study of specific customers' problems, is one of three Scovill services, well-known throughout Industry. *Service in Men* provides specialized advice on tube problems, installation aids and "follow-up" services. *Service in Manuals* offers valuable literature on condenser and heat exchanger tubes. For a copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

Top: Plain Admiralty.
Bottom: Phosphorized Admiralty.

75 x magnification.
Average grain size .035 min.



Mechanical Properties at Elevated Temperature



Plain Admiralty		Phosphorized Admiralty	
Copper	70.0 — 73.0	Copper	70.0 — 73.0
Tin	0.90 — 1.20	Tin	0.90 — 1.20
Lead	0.075 max.	Lead	0.075 max.
Iron	0.06	Iron	0.06
Phosphorus		Phosphorus	0.10 max.
Zinc	remainder	Zinc	remainder

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CATALOGS and BULLETINS

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CHECK BULLETINS DESIRED ON COUPON AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 RADIO STATION: A 4-page brochure features a 50-watt ground radio station. This unit is designed for small airports, airlines, and communication systems. Electrical and mechanical specifications are included. Aireon Manufacturing Corp.

2 BREATHING APPARATUS: Bulletin BM-8 presents a new development in respiratory protection. This apparatus employs a replaceable chemical canister which permits it to generate its own oxygen, thus giving the wearer one hour's protection in unbreathable air. Weighing but 13½ lb. complete, with no cylinders, high-pressure valves or fittings, this new napparatus is suited to the requirements of industry and fire departments in meeting any emergency where high concentrations of poisonous gas or oxygen deficiencies are encountered. Mine Safety Appliances Co.

3 BALLASTS: Four-page folder outlines by the use of tables, necessary data regarding ballasts. Includes information on the size ballast used with number and size fluorescent lamps. Circuit voltages and prices also listed. American Transformer Co.

4 CATHODE-RAY TUBES: Two folders outline briefly principles of cathode-ray tubes having highly specialized applications. Information given includes characteristics. Technical nomenclature is noted on construction drawing of each type of tube. A "How to Draw" sheet is also included. Allen B. Mont Laboratories, Inc.

5 BALLASTS: A 24-page catalog contains a complete line of ballasts to meet all kinds of lighting conditions. Included in text is information on construction features of each kind of ballast, for which outlines and wiring diagrams are given showing methods of connecting ballast to lamps. Supplements to text are also included. General Electric Co.

6 MINIATURE BALL BEARINGS: Catalog No. 5 features a wide choice of miniature ball bearings. This wide selection, including over 200 types and sizes, enables the user to select the right bearing for every need. The "R" and "E" precision series represent recent developments, and are made to dimensions and tolerances laid down by the International Standardization Association. Also included are certain new types of radial bearings. Landis & Gyr, Inc.

7 SPRAY NOZZLES: Bulletin N-616 presents a story on spray nozzles, used for cooling condensating water, for air-conditioning service and for many industrial processes. Photographs of equipment as well as construction drawings showing methods of laying out a piping system, are included. Virtually every application where this equipment is used is shown graphically and pictorially. Yarnall-Waring Co.

8 MOTORS: Bulletin No. B-3466 describes in detail slasher drives, lint-free motors, loom motors, and other electrical equipment for the textile industry. Included are pictures of actual installations of horizontal and vertical motor drives for openers, pickers, and cards. Specially designed lint-free motors for maximum production from spinning frames are also discussed. Westinghouse Electric Corp.

9 RUBBER AND SYNTHETIC PRODUCTS: A new 12-page booklet on rubber and synthetic products features many possible applications for these materials. Opening pages are devoted to Koroseal's physical and chemical properties. Two pages are given to uses of rubber and metal which reduce vibrations of machinery. Rubber-lined equipment, including tanks and tank cars for handling corrosive acids or alkalies as well as valves, pipes and fittings, are described and pictured. The B. F. Goodrich Co.

10 ELECTROPLATING EQUIPMENT: A 12-page booklet, outlining methods of electroplating electrical equipment of all sizes, illustrates how this apparatus can be used advantageously. Several pages are devoted to a discussion of electroplating solutions, giving prices of each solution and indicating types of plating brushes used. Ajax-Consolidated Co.

11 INSULATING MATERIALS: Bulletin No. 144 discusses ceramic insulator bodies, their physical and electrical characteristics. Typical designs are grouped according to the industry in which they are used. Includes electrical, electronic, industrial heating, chemical, automotive and other fields. Property charts and other

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February 2, 1946

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330 West 42nd St., New York 18, N. Y.

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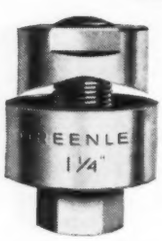

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technical data, together with practical information on manufacturing processes, are also included. American Lava Corp.

12 ELECTRONIC MOTOR CONTROLS: This 4-page folder features full range, adjustable, stepless, electronic speed controls used on equipment in heavy industry, medium industry and special industries. Technical data on operating features are supplied with several schematic diagrams. Electron Equipment Corp.

13 TRANSFORMERS: Catalog No. 444 contains 16 pages of pertinent data covering various and significant features of this manufacturer's product. Illustrations, construction drawings and cutaway views of equipment are given. Kuhlman Electric Co.

14 STATIC ELIMINATOR: Folder features ionizing static eliminator, giving technical details explaining why it is effective in eliminating static electricity from moving paper, plastic sheeting textiles, and other products or machinery. Diagram showing construction is supplied. United States Radium Corp.

15 MOTOR STARTER SWITCH: Bulletin No. EM-45 features a motor starter switch designed for use on machines operating on a.c. or d.c. current. Illustrations and wiring diagrams showing mounting dimensions are also given. The National Acme Co.

16 PLASTICS: A 20-page catalog discusses moulding materials made out of the cellulose acetate, ethyl cellulose, polystyrne and vinyl compounds. Illustrations are given showing wire insulation, gaskets, wire covering jackets, terminal insulation and housings—all moulded from these plastic compounds. Chemaco Corp.

17 CERAMICS: Bulletin No. 245 features ceramic designed for all frequencies, voltages, and temperatures. List of products made from this material include thermocouple insulation and protection tubes, condensers, trimmer and padder bases, transmission line insulators, radio tube spacers and bases, etc. Stupakoff Ceramic and Mfg. Co.

18 MOTORS: Bulletin No. 103 describes and illustrates several sizes of squirrel cage induction motors. Technical details are supplied, showing special construction features. Continental Electric Co., Inc.

19 TRANSFORMERS: Bulletin No. CV-102 contains information on the application of constant voltage transformers, including lighting, oil burner ignition and radio, series lighting. Charts and wiring diagrams are also supplied. Sola Electric Co.

20 DUST RECOVERY SYSTEMS: A 32-page booklet discusses the importance of industrial dust recovery. Technical details of system are given showing types of cyclones used. Also lists the industries where dust recovery systems are installed. Buell Engineering Co., Inc.

21 AUTOMATIC CONTROLS: A 50-page catalog contains complete line of automatic controls. Includes airswitches, flow meters, combustion controls, humidity controllers, mercury switches, pilotstats, electric radiator valves, refrigeration con-

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications

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—and neither will inadequate wiring run electrical equipment at FULL CAPACITY

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IF A MACHINE is running 1500 RPM, and it should run 1800 RPM, don't blame the operator. Chances are that *reduced voltage* is curtailing the machine's production. In fact, inadequate wiring can reduce efficiency as much as 25% to 50%!

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Talk it over with consulting or plant power engineer, electrical contractor or power salesman. They'll advise: Wire Ahead! Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company, 25 Broadway, New York 4, N. Y. Sales Offices in Principal Cities.

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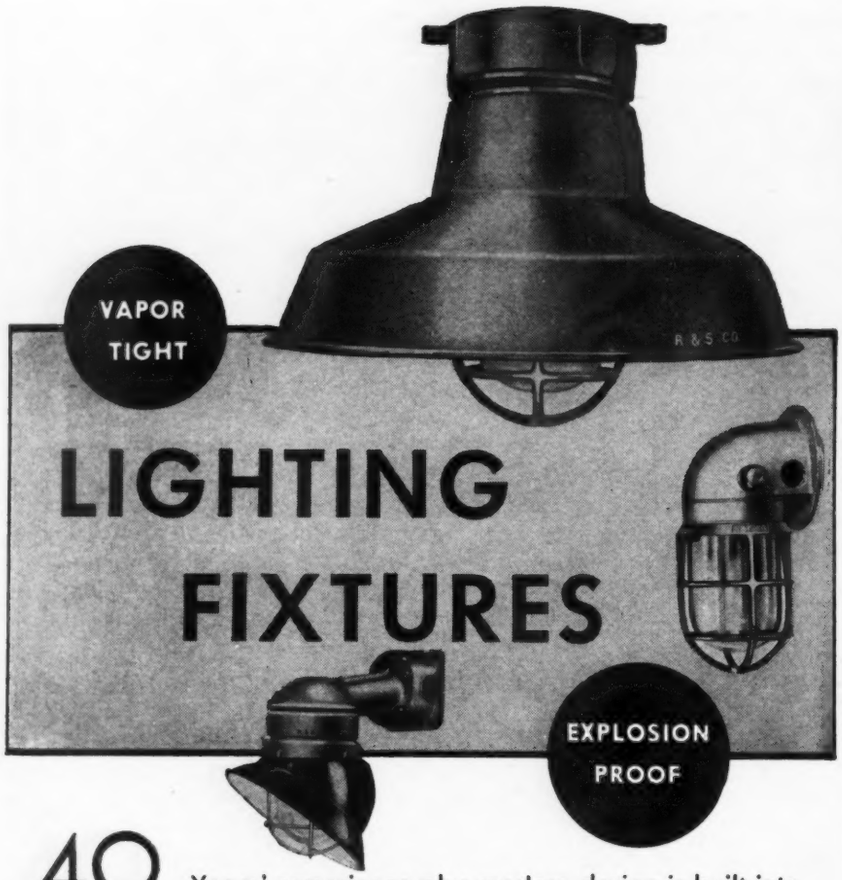

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trollers, relays, temperature controllers, etc. Price list is supplied. Minneapolis-Honeywell Regulator Co.

22 HAND TOOLS: A collection of sheets from manufacturer's catalog lists a variety of hand pruning tools, including insulated tree trimmers, wire cutters and shears of all types. Specifications and prices are given. Newman Mfg. and Sales Co.

23 RESISTANCE WELDING ELECTRODES AND ALLOYS: A 32-page bulletin contains several lists of various types of spot welding tips, dressers, tip holders, etc. Includes cutaway drawings with dimensions, illustrations and engineering data. P. R. Mallory & Co., Inc.

24 LIGHTING: Several newly designed fluorescent fixtures for commercial use are featured in this 16-page catalog. Contains photographs, illustrations and distribution curve for each fixture. A. L. Smith Mfg. Co.

25 STRAPS AND HANGERS: A 4-page folder describes and illustrates application of messenger straps, cable and conduit hangers. Construction drawings with dimensions are also given. Minerallac Electric Co.

26 WIRING ACCESSORIES: Several bulletins grouped together describe and illustrate potheads, junction and subway boxes and connectors. Construction drawings are also given. Rusgreen Mfg. Co.

27 INDUSTRIAL X-RAY EQUIPMENT: A 12-page booklet describes several models of X-ray machines, used for the internal inspection of castings and parts; for locating structural or assembly defects, and improving quality. Photographs and specifications are also shown. North American Philips Co., Inc.

28 ELECTRODE HOLDER: Folder describes and illustrates electrode holder, showing various component parts and how such parts can be dismantled from complete units. Albert & J. M. Anderson Mfg. Co.

29 LIGHTING: This 8-page bulletin contains several newly designed fluorescent fixtures. Detailed drawings with distribution curves are included. F. W. Wakefield Brass Co.

30 CABLE: Catalog No. 21 contains information on complete line of bare and weatherproof wire and cable with physical properties, specifications and other pertinent engineering data. Photographs of company plant illustrates some of the operations employed in obtaining the finished product. Rome Cable Corp.

31 HEATING SYSTEMS: Folder discusses special type of electric heating cells, designed especially for industrial processing. Diagrams and construction drawings are given to show how units operate. Belgau Heating Systems.

32 INSTRUMENTS AND ACCESSORIES: Booklet contains a complete listing of electrical instruments and accessories, such as resistors, galvanometers, wheatstone bridges, kilovoltmeters, etc. Engineering data, illustrations, charts and graphs are supplied. Shalleross Mfg. Co.

33 WAXES AND COMPOUNDS: A 64-page handbook devoted to the discussion of insulating and sealing waxes and com-

Highway Reel and Pole Trailers

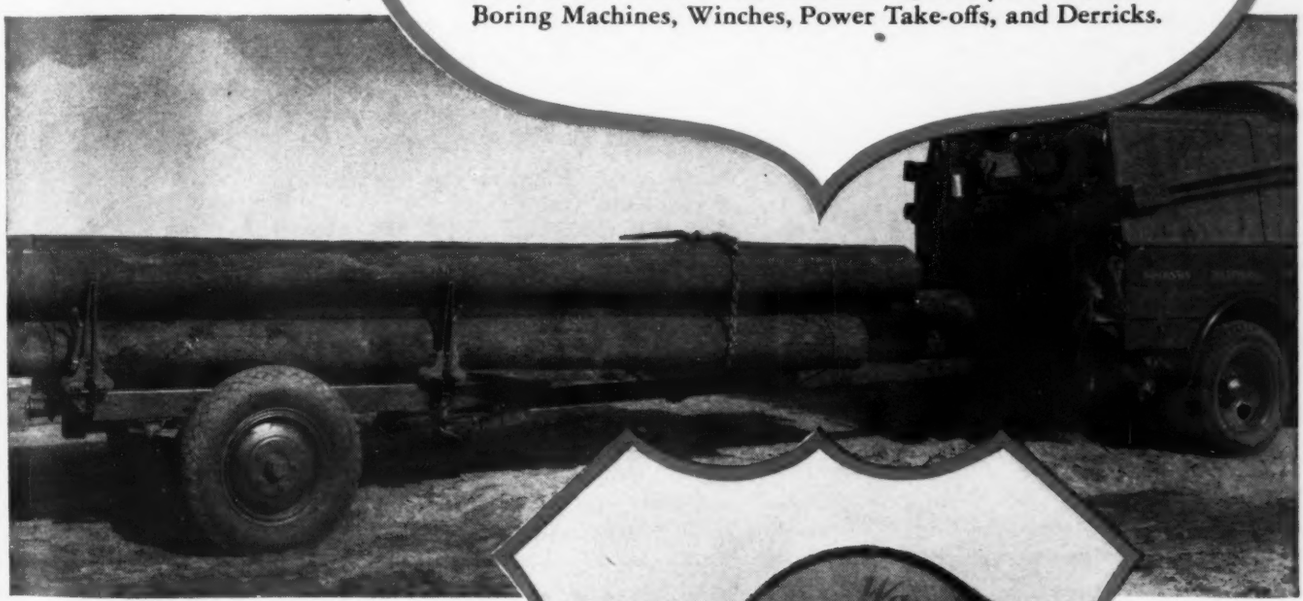
save time, cut costs

TRANSPORTING cable reels and poles is reduced to a safe, simple, easy operation by specially designed Highway Trailers. Heavy, unwieldy cable reels are quickly loaded by tipping back the Highway Cable Reel Trailer until saddles engage the reel spindle, then pulling tongue down and coupling it to the truck. Highway Pole Trailers are coupled to any line construction truck, doing away with the old special-truck-and-bolster nuisance.

These and other Highway equipment are the logical outgrowth of over a quarter-century's experience in successful trailer engineering. For years Highway trailer engineers have enjoyed the closest cooperation with leading engineers in the fields of communications and public utilities. By knowing your problems, thoroughly, Highway has been able to work out the right answers.

Before you buy new equipment, learn about Highway Line Construction and Maintenance Bodies, Utility Bodies, Earth Boring Machines, Winches, Power Take-offs, and Derricks.

Highway Pole Trailers and Cable Reel Trailers are saving time and money for many of the leading companies in the field from coast to coast.



HIGHWAY TRAILER COMPANY

Manufacturers of

Utility Bodies • Winches • Earth Boring Machines • Pole and Cable Reel Trailers and Other Public Utility Equipment

EDGERTON, WISCONSIN, U. S. A.

Long-Span Construction Cuts Rural Line Costs

Savings of $100 to $120 per mile have been reported where *Crapo* Steel Conductors have been used in long-span rural distribution lines. These savings will be an important consideration in the rural power expansion program which lies ahead.

Crapo Steel Conductors are especially applicable to the tap and branch lines which make up a substantial part of the rural mileage yet to be built. These ferrous conductors, with their relatively low 60-cycle resistance and reactance, will carry the voltages and loads ordinarily imposed on typical rural extensions with a voltage drop well within prescribed limits.

I^2R losses on rural lines built of *Crapo* Steel Conductors are so small as to be negligible especially when compared with the potential overall savings. The high rugged strength of these conductors makes possible extra long spans, reduces the number of pole structures per mile, cuts material and labor costs, minimizes maintenance.

Complete Technical Information

Investigate the practical economy of *Crapo* Steel Conductors for your post-war rural program! Ask a representative of Graybar Electric Company, Inc., Distributor, or write direct for a copy of our Engineering Manual!

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo HTC-130 STEEL CONDUCTORS

pounds, asphalts and similar hydrocarbons, giving properties and technical data for each. Mitchell-Rand Mfg. Co.

34 MOTORS: An 8-page catalog presents specifications and descriptions of standard motors, illustrating typical applications in hoists, comminutors, canning machinery, diesel generators, dry-cleaning machinery, printing equipment, machine tools and other equipment where severe service conditions are encountered. Star Electric Motor Co.

35 PRODUCTION WELDING CONTROL SYSTEM: Bulletin W-47 outlines the need for an accurate control system for production welding. This 16-page brochure asks questions and answers them. Harnischfeger Corp.

36 METERS, RELAYS AND INSTRUMENTS: Catalog No. 40 contains 160 pages of illustrated material, including complete line of electrical equipment which this company carries. Dimensions, specifications and diagrammatic drawings are also included. Superior Switchboard & Devices Co.

37 PORTABLE ELECTROPLATING OUTFITS: A 4-page folder outlines briefly the methods used in silver plating bus bars, switch contacts, cable lugs, breaker contacts, etc., with this hand-operated apparatus. W. A. Hesse & Co.

38 TACHOMETER: Bulletin No. 12 discusses several models of tachometers suitable for industrial rpm. or surface speed measurements. Units for permanent and portable installations are illustrated. List prices are also shown. Chicago Electric Tachometer Co.

39 CRYSTALS: Catalog contains a complete listing of the line of crystals which this company carries. Illustrations and diagrams are included for each type of crystal with the frequency range, tolerance, drift given. The James Knights Co.

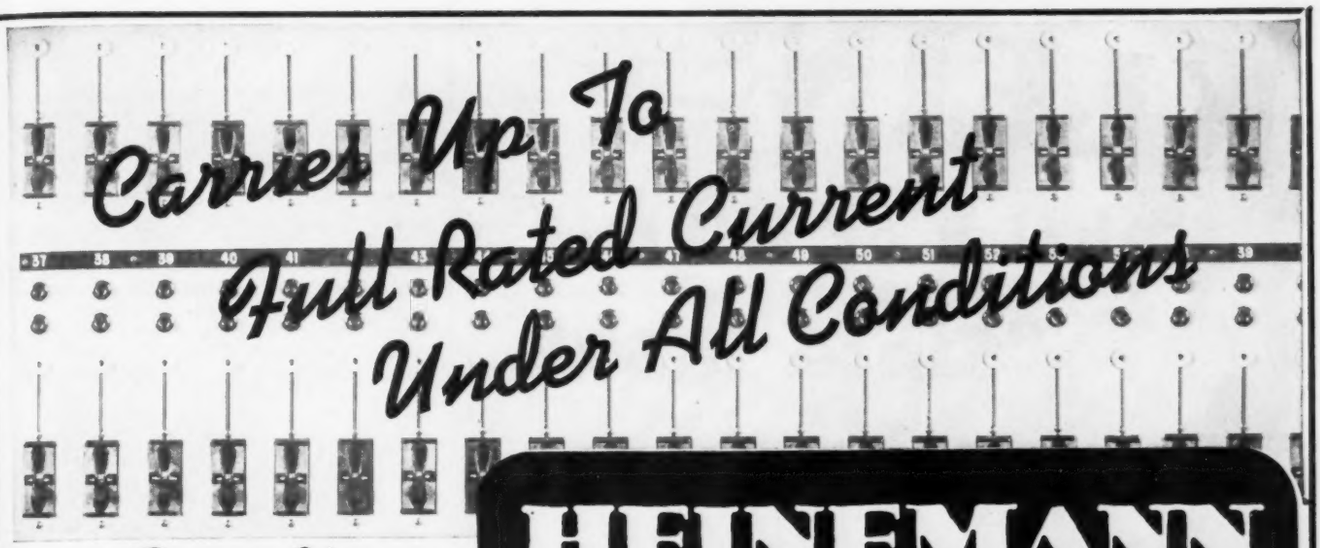
40 LIGHTING: Catalog No. 285 describes and illustrates commercial fluorescent luminaires for offices, stores, schools and public buildings. Pertinent engineering data given to facilitate installation of units. Distribution curve of each unit is shown. Mitchell Mfg. Co.

41 TESTERS AND GRIPPING JAWS: Bulletin No. 442 contains 8 pages of illustrations showing the materials on which these instruments are used to ascertain tensile, compression, transverse and shear strength of each size and shape of material. W. C. Dillion & Co., Inc.

42 TRUCKS: Folder features advanced engineering and design data concerning this particular make truck. Illustrations show new truck models giving size and special features of each model. The Four Wheel Drive Auto Co.

43 RADIO PARTS AND INSTRUMENTS: A 70-page post-war supplement to a bulletin put out by this company includes and describes equipment made available since the publication of the first edition. General Radio Co.

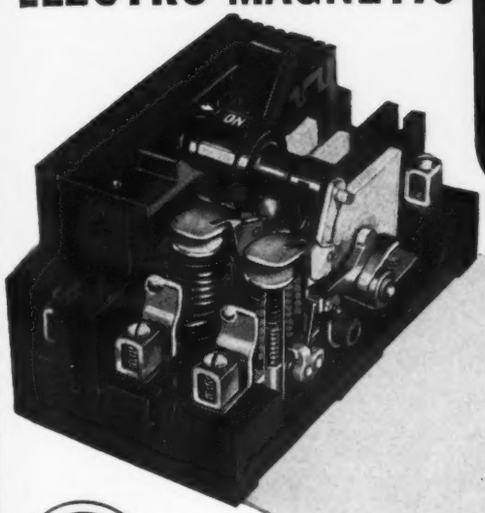
44 BOILER FEED WATER CONTROLS: Bulletin 441, a 24-page catalog, features a flowmatic feed water control



Carries Up To Full Rated Current Under All Conditions

HEINEMANN MAGNETIC CIRCUIT BREAKER

Because It's
ELECTRO-MAGNETIC



The HEINEMANN CIRCUIT BREAKER will never trip *before* the current reaches the trip point specified, because it does not depend on any thermal unit, but is *entirely magnetic* in its action. No matter what the surrounding temperature, the HEINEMANN CIRCUIT BREAKER will trip only on a load in excess of its rating.

HEINEMANN CIRCUIT BREAKERS are made with and without time-delay. Each time-delay type breaker has a hermetically sealed, liquid-filled tube surrounded by a coil of wire. On overcurrent, a plunger in the tube becomes a powerful magnet and is drawn toward the pole piece which then attracts the armature and opens the contacts. The speed with which the plunger is drawn toward the pole piece depends on the viscosity of the liquid and the magnitude of the overload.

HEINEMANN BREAKERS are available in any rating between 10 milliamperes and 50 amperes, with a selection of time-relays in single, two pole and three pole as shown. The same breaker may also be had with instantaneous trip, where current is applied gradually up to rated load.

The 1946 Model HEINEMANN CIRCUIT BREAKERS are smaller and more compact than anything Heinemann has made heretofore.

Send for NEW Catalog Showing Complete Line and Engineering Data.

HEINEMANN CIRCUIT BREAKER CO.

Subsidiary of Heinemann Electric Co., Est. 1888

103 PLUM STREET — TRENTON, N. J.

KLEINS

choice of utilities

"Since 1857"

201 N. E. Klein's famous "streamlined" Side Cutting Plier. Made in four sizes, 6, 7, 8 and 9 inches.

The first pair of Klein Pliers ever made was designed for the Public Utility field. Since that time, serving Utilities has been our major business.

Today Mathias Klein and Sons produces a complete line of pliers to cover every need of linemen and electricians. All have the extra stamina—the plus quality that electrical service demands. That is why Kleins are standard equipment with Public Utility Companies today as they were when the first wires were strung.

ASK YOUR SUPPLIER

***Foreign Distributor:* International Standard Electric Corp., New York**

This book on the care and safe use of tools will be sent on request.

242 Klein Oblique Cutting Plier (heavy-duty pattern). A very useful tool that cuts close. Length 6 inches.

301 Klein Long Nose Plier. The long reach of the jaws permits getting into difficult places. Made in 6 and 7 inch sizes.

Since 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

system. Included are illustrations, graphs, diagrams and construction drawings. Northern Equipment Co.

45 BATTERIES: Catalog No. 100 presents technical data covering industrial truck and tractor batteries. Illustrations and cutaway drawings showing the component elements of each battery are given. Physical dimensions are also included. Gould Storage Battery Corp.

46 WOOD TRANSMISSION STRUCTURES: Bulletin 17 features the various types of wood substation structures in use. Construction details for transmission structures are shown complete with details and dimensions. Trend in this field is also discussed. Hughes Bros.

47 CONVEYOR BELTS: A 4-page folder outlines differences and measurements of qualities in various type belts and the uses to which each type of belt is applied. The B. F. Goodrich Co.

48 LINEMEN'S RUBBER PROTECTIVE DEVICES: Catalog L-4 contains a list of manufacturer's products, used principally in overhead line construction work. Some of the equipment discussed includes line hose connectors, insulator hoods, lineman's blankets, non-spillable P. B. paint pots, cable bandages, rubber gloves, etc. W. H. Salisbury & Co.

49 PAINTS: This 16-page booklet, "Color for Industry," discusses paint in its relation to seeing, showing in each case the advantages of using a certain color paint for a specific type job. Psychological effects of color and efficiency are discussed. U. S. Gutta Percha Paint Co.

50 WIRE: A collection of engineering data sheets compiled into a folder on complete line of manufacturer's products with tables for stranded and solid bare wire of various strengths, overhead ground wires, power conductors, telephone and signal, guy and messenger. Also included are sections on construction practices and sag data. Copperweld Steel Co.

51 MAGNETIC CIRCUIT BREAKERS: Catalog No. 131-3-5M contains and discusses every make of circuit breaker manufactured by this company. A section is devoted to engineering data. Wiring diagrams and overload curves are given. Heinemann Circuit Breaker Co.

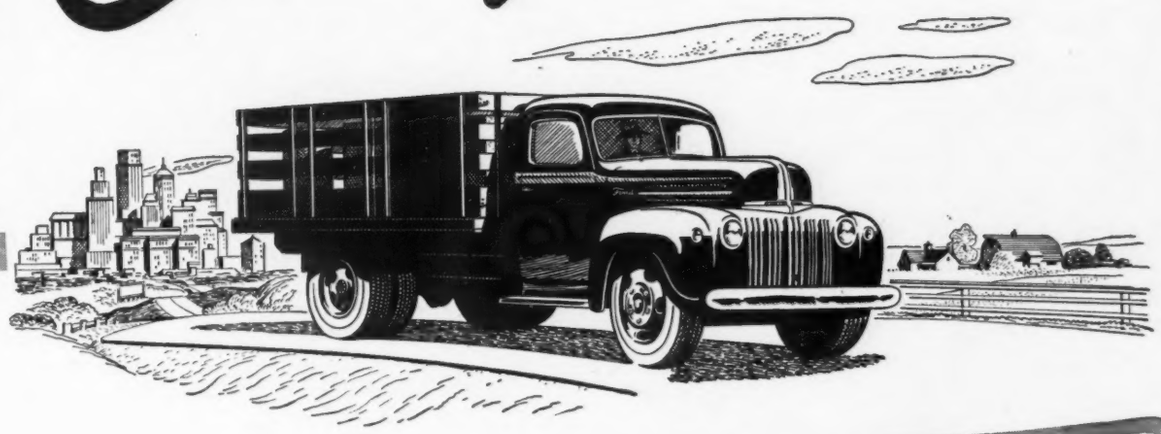
52 SPECIALIZED PLUGS, CONNECTORS AND SOCKETS: A cabinet file describes and illustrates radio tube connectors for a variety of applications, molded tube sockets with various types of prongs, detachable terminal connectors, two-piece plugs, miniature connectors, adapters and analyzer kits, dial light sockets. Each section contains plan drawings and specifications. Alden Products Co.

53 LIGHTING: Bulletins 198-F, 199-F, 200-F, each contain installation details for a typical baseball park. These are technical bulletins illustrating the use of floodlights for lighting a baseball field, and includes all the equipment used, together with detailed drawings showing method of installing this equipment. Crouse-Hinds Co.

54 RESISTANCE HANDBOOK: A 108-page handbook on resistance alloys for electrical, radio, automotive, mechanical, chemical industries. Wilbur B. Driver Co.

Ford

FORD TRUCKS Everywhere!



✓ 32 IMPORTANT New ENGINEERING ADVANCEMENTS

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✓ 51 BODY AND CHASSIS COMBINATIONS

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✓ TWO GREAT FORD ENGINES— THE 100 H.P. V-8 and the 90 H.P. SIX

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LOW OPERATING COST

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Availability of Service and Parts- Everywhere, Quickly

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NEWS ABOUT PEOPLE

Roy Godley Joins E.E.I. As Rural Service Manager

Roy Godley, head of the rural department of Monongahela Power Co., Fairmont, W. Va., will assume the newly established position of Rural Service Manager in the commercial department of the Edison Electric Institute, effective February 1. In this position, Mr. Godley will assist the electric industry in expansion of its rural electrification activities, including the fostering of all types of applications of electric service with the view of increasing the farm income, particularly that of the self-subsistence farm. He will also engage in furthering cooperative relations between the electric industry and all other groups and organizations interested in agricultural development.

R. Godley

Following graduation from West Virginia University with a master of science degree in agriculture, Mr. Godley spent two years as County Agricultural Agent, Ritchie County, W. Va. In 1936 he joined Monongahela Power Co. as agricultural counselor, and in 1944 became head of the rural department.

While with the power company, he formulated an agricultural development program, known as Farming for Better Living, designed to supplement the work of such agencies as the Agricultural Extension Division in increasing farm income.

Mr. Godley is a member of the equipment distribution committee and sales personnel committee of the Edison Electric Institute and an associate member of the American Society of Agricultural Engineers.

•

C. J. Nevitt Promoted by San Diego Utility Co.

Clem J. Nevitt, assistant superintendent of the electric transmission and distribution department of the San Diego Gas & Electric Co., has been appointed superintendent of the department to succeed A. S. Glasgow, retired.

C. J. Nevitt

Mr. Nevitt received his electrical engineering degree from the University of California in 1931, and later became associated with the San Joaquin Light & Power Co. Subsequently he moved to San Diego to work for the city's water, utility evaluation and engineering departments, and in 1936 he joined the San Diego Gas & Electric Co.'s engineering department. It was in 1945 that Mr. Nevitt was made assistant superintendent of the electric transmission and distribution department.

Mr. Glasgow had been with the San Diego utility since 1916.

Kuhlman Electric Appoints Manning Chief Engineer

Melvin L. Manning, formerly assistant chief engineer of the Kuhlman Electric Co., Bay City, Mich., has been promoted to the position of chief engineer in charge of electrical and mechanical design and development.

M. L. Manning

Mr. Manning was connected with the Westinghouse Electric Corp. for ten years as a motor design engineer, transformer design engineer and research engineer in the transformer division (1937-1942) where he participated in fundamental standardization work in high voltage practice.

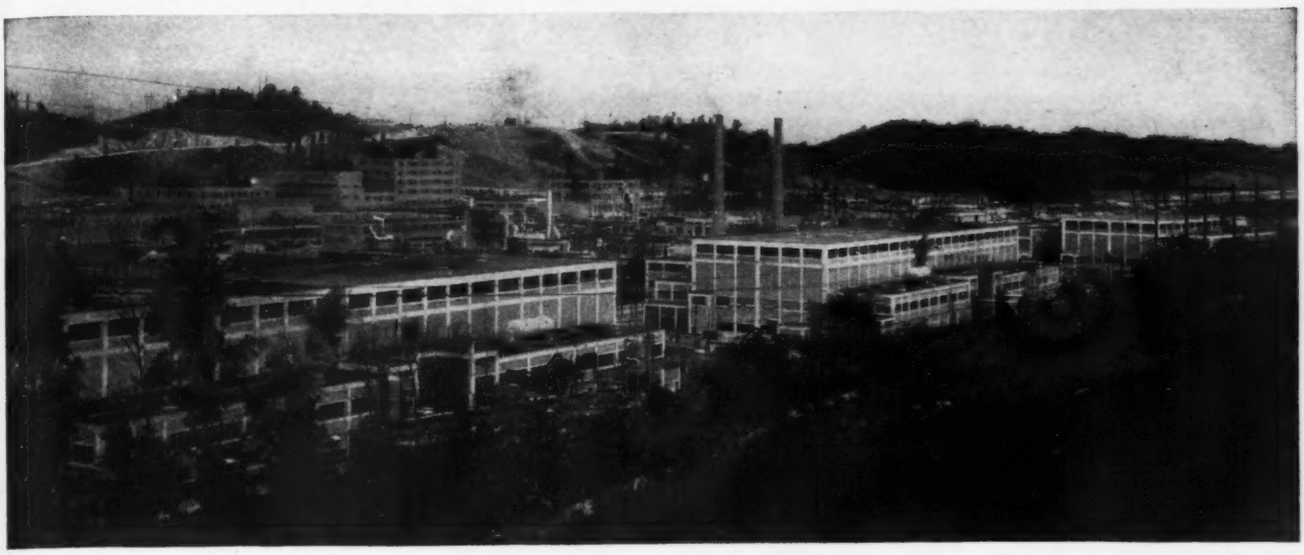
He spent eight years in educational activities interwoven with and after the industrial experience. In 1942 he became associate professor of electrical engineering at Illinois Institute of Technology and in 1943 was appointed associate professor of electrical engineering and director of the new high voltage research laboratory at Cornell University, Ithaca, N. Y. Mr. Manning joined the Kuhlman Electric Co. early in 1945.

•

Sir Edward V. Appleton Gets Faraday Medal

Sir Edward V. Appleton has been awarded the Faraday Medal of the Institution of Electrical Engineers (British) for his work in developing radio-location devices. Sir Edward was war-time secretary of the British Department of Scientific and Industrial Research. He is vice-president of the American Institute of Radio Engineers.

Sir Edward was born in 1892 and received his education at Cambridge. In the course of his academic career, he was connected with the teaching staff of Trinity College, the University of London and Cambridge University. He has written



ELECTROMAGNETIC

Stone & Webster Engineering Corporation recommended the electromagnetic process among several possibilities as the quickest way to mass produce U-235—the essential element in the Atomic Bomb.

How successful this process was is indicated in the Smyth Report.

We quote:

"Construction of the first series of electromagnetic units at Clinton began in March of 1943 and this part of the plant was ready for operation in November 1943."

8 MONTHS TO FIRST OPERATION

"For nearly a year the electromagnetic plant was the only one in operation."

A YEAR AHEAD IN PRODUCTION

"The electromagnetic separation plant was in large-scale operation during the winter of 1944-1945 and produced U-235 of sufficient purity for use in atomic bombs."

QUALITY AND QUANTITY PROVED.

ENGINEERS & CONSTRUCTORS
of one of the
MAJOR ATOMIC BOMB PLANTS
AND THE CITY OF
OAK RIDGE, TENNESSEE

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

various original papers on electricity and the scientific problems of wireless telegraphy.

•

Oklahoma Utilities Group Elects New Officers

Announcement has been made by the Oklahoma Utilities Association of the election of officers for the year 1946.

They are: president, A. F. Potter, The Gas Service Co., Bartlesville; first vice-president, S. I. McElhoes, Public Service Co. of Oklahoma, Chickasha; second vice-president, L. A. Farmer, Northern Oklahoma Gas Co., Ponca City, Okla.; treasurer, E. C. Joulliam, Consolidated Gas Utilities Corp., and secretary, Miss Kate A. Niblack, Biltmore Hotel, Oklahoma City, Okla.

D. S. Kennedy, vice-president and treasurer, Oklahoma Gas & Electric Co., Oklahoma City, is the retiring president of the association.

•

▶ A. J. Batchelor, superintendent of the underground department of the Toledo Edison Co. since 1929, has been named assistant manager of the Defiance Division. Mr. Batchelor joined the Edison company in 1914 as a draftsman in the engineering department. Later he worked in the line and underground departments, subsequently returning to the engineering department in charge of survey and records. In 1926 he was made engineer for the underground department and held that position until promoted to superintendent.

▶ Vladimir Karapetoff, professor of electrical engineering (emeritus) at Cornell University, was the guest of honor at a dinner held in New York on January 21. The occasion marked not only the annual Kary dinner, but in addition the seventieth birthday of Professor Karapetoff. The dinner was sponsored by Eta Kappa Nu.

▶ Frank A. Dawes of Hollister, Mo., has been appointed chief of the cooperatives operations division of the Rural Electrification Administration to succeed T. J. Robertson of Arkansas, resigned. Since 1941, Mr. Dawes has been manager of the White River Valley Electric Cooperative, Inc.

▶ Allan Brown has been elected vice-president of the Bakelite Corp., in charge of advertising and public relations and George C. Miller has been elected vice-president and general sales manager of the thermoplastic department.

Sylvania Elects Mitchell Executive Vice-President

Don G. Mitchell was elected executive vice-president of Sylvania Electric Products Inc. at a recent meeting of the

D. G. Mitchell

board of directors. Mr. Mitchell joined Sylvania as vice-president in charge of sales in 1942.

Prior to his connection with Sylvania, Mr. Mitchell was connected with the Pepsi-Cola Co. and with the American Can Co.

•

▶ Ambrose L. Kerrigan, formerly electrical engineer of the Fitchburg (Mass.) Gas & Electric Light Co., has been appointed general superintendent of the company, following his return from the armed forces with the rank of lieutenant-colonel after three years' war service. He was graduated from Massachusetts Institute of Technology in 1921, and after serving in the regular army for about 18 months, attaining the rank of first lieutenant, he became a tester for New York Edison, and then physicist for Westinghouse Lamp Co., Bloomfield, N. J. From 1924 to 1926 he was an electrical engineer with the then Charles H. Tenney & Co. organization, Boston, going thence to Fitchburg. In his latest position he will be in charge of gas production and distribution, engineering, stock, electrical distribution, production, metering and garage service.

▶ William D. Robertson has joined the staff of the National Electrical Manufacturers Association as manager of the industrial relations department. Since 1942, Mr. Robertson has been with the Bell Aircraft Corp. successively as labor relations representative, manager of labor relations of the Niagara Frontier Division, assistant director of labor relations for the corporation and assistant manager of industrial relations for the Ordnance Division. From 1937 to 1942 he was with Buffalo Niagara Electric Corp. in promotional, customer relations and personnel work. While associated with Bell Aircraft Corp., Mr. Robertson taught special courses on collective bargaining and current labor problems at the University of Buffalo.

•

Taylor Made Vice-President of St. Joseph Utility

R. E. Taylor, formerly district manager of the Iowa-Illinois Gas & Electric Co. in Iowa City, has been made vice-president of the St. Joseph Light & Power Co., St. Joseph, Mo. Both properties are in the United Light & Railways Co. system. R. H. Lind, Davenport, has been appointed district manager of Iowa-Illinois Gas in Iowa City to succeed Mr. Taylor.

A graduate of the University of Chicago, Mr. Taylor started his business career in 1920 as chief clerk of the Ottumwa Gas Co. Since the formation of the Iowa-Illinois Gas & Electric Co. in 1942, he has been a member of the board of directors, and district manager in Iowa City. Prior to that, he was general manager of the Iowa City Light & Power Co., predecessor company in Iowa City, for a period of six years.

Mr. Lind has been associated with the Iowa-Illinois Gas & Electric Co. and its predecessor company in Davenport throughout his entire business career.

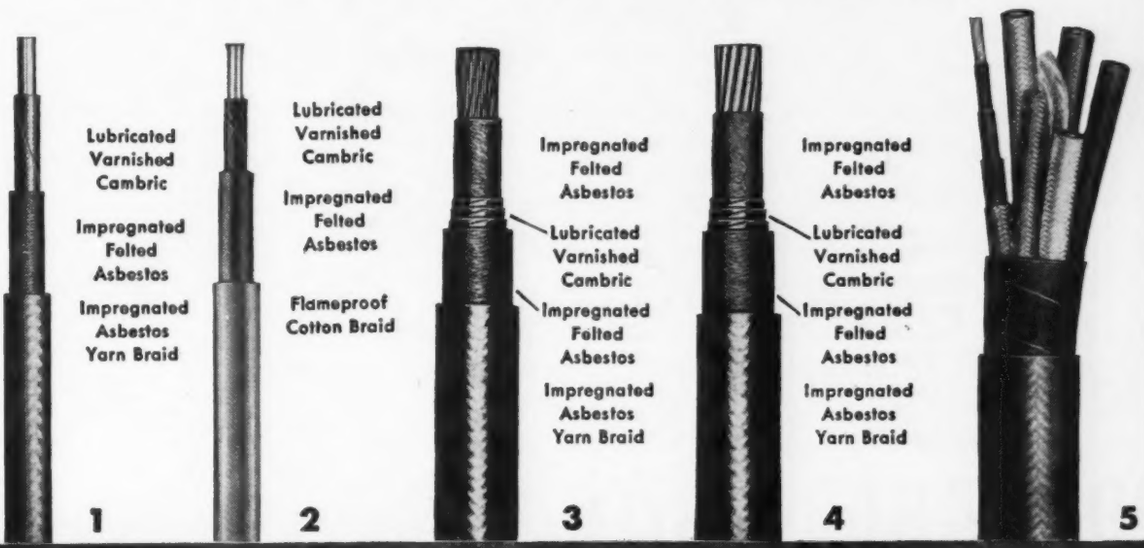
•

▶ James S. Crooks has been appointed chief operating engineer of the Monongahela Power Co., Fairmont, W. Va., to fill the vacancy caused by the death of the company's general line superintendent, William F. Nimblett. Mr. Crooks went to Monongahela from the West Penn Power Co. in 1930, starting as a distribution engineer. His new position will include all the activities of the lines section plus the former operating engineering section.

▶ E. Bruce Bynum, manager of the Jackson, Tenn., electric department, has been named by the Memphis City Commission to serve as a member and vice-president of the Memphis Light, Gas and Water Commission. Mr. Bynum is assuming the duties formerly performed by the late Joseph J. Brennan. A graduate of the University of Alabama, Mr. Bynum has had considerable electrical engineering experience. He was connected with the Alabama Power Co. for several years, serving as district engineer at Birmingham from 1935 to 1937. He then became identified with the Tennessee Valley Au-

5-POINT PROGRAM

for Eliminating Wire-Failures in Control, Power and Lighting Circuits exposed to Severe Operating Conditions



1. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Boiler Room Wire in sizes No. 18 to 4/0 AWG. For lighting and control circuits around boilers, furnaces, steel mills, etc., and resistor wiring.
2. **National Electrical Code Type AVB** (max. operating temperature 194° F.) Rockbestos A.V.C. 600 Volt Switchboard Wire in sizes No. 18 to 4/0 AWG. For fireproof switchboard wiring. Takes right angle bends without cracking braid. Rockbestos A.V.C. Hinge Cable and Bus Cable also available.
3. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Flexible Motor Lead Cable in sizes No. 18 AWG to 1,000,000 CM. For coil connections, motor and transformer leads exposed to heat and moisture, oil, grease and fire hazard.
4. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Power Cable in sizes No. 18 AWG to 2,000,000 CM. For power circuits and hot-spot wiring in generating and industrial plants.
5. Rockbestos A.V.C. 600 Volt Multi-Conductor Control Cable in standard sizes, No. 12—19/#25 and No. 9—19/#22 (other strandings on order) with from two to nineteen conductors insulated the same as Rockbestos A.V.C. Power Cable except braids on individuals which are coded cotton.

When expanding generating capacity, protect circuits exposed to high ambient temperatures, or heating and cooling cycles, by installing failure-prevention and greater current carrying capacity with Rockbestos A.V.C.

These National Electrical Code type *permanently insulated* Rockbestos developed wires are insulated with the time-tested combination of lubricated varnished cambric and *impregnated felted asbestos* that stands up under high temperatures and conductor-heating overloads without baking brittle or flowing . . . without cracking under vibration . . . without rotting or swelling in contact with oil, grease or fumes . . . and without burning when exposed to flame.

Rockbestos A.V.C. has ample moisture resistance for conduit installations and for dry high-temperature applications there are many other *permanently insulated* Rockbestos All-Asbestos (N.E. Code Types) wires, cables and cords in our line of 125 different standard constructions. Specify them for long, dependable service under severe conditions in valve control circuits, grid connections, motor and transformer leads . . . and for circuits in boiler rooms, steam tunnels, pump rooms, ash pits or other hot spots.

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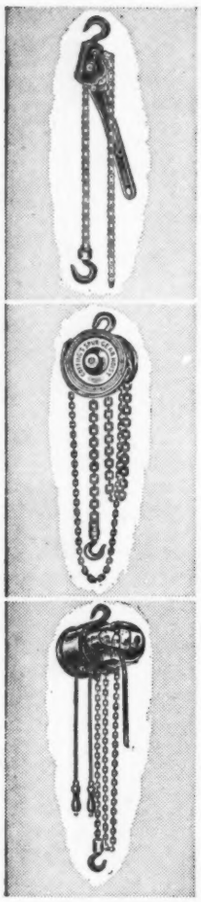
The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.



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Coffing Hoists are sold by leading distributors and supply houses in all principal cities.

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One-piece molded crown vulcanized to extreme strength and rigidity, with underside reinforcing. Patented headband and cradle prevent sway; attachable or detachable headband; moisture-proof, comfortable, durable, highly protective against impact or electric contacts. Ten head sizes.

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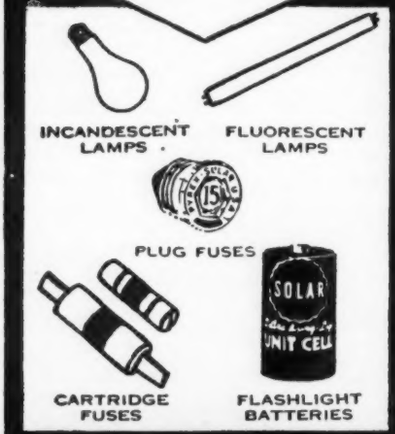


Quotation on request

SOLAR ELECTRIC CORPORATION

WARREN, PENNSYLVANIA

thority and in this connection engaged in a wide variety of engineering work. In 1942 he became manager of the Jackson Electric Division and since that time has been responsible for the management and operation of the electric distribution system in Jackson, including supervision of engineering, construction, operation, accounting, load development and all financial transactions of the department.

•

New Assignments Made by General Electric Co.

WILLARD C. BROWN, widely known illuminating engineer, has returned to engineering division at General Electric Co.'s Nela Park to become assistant to the manager of that division after serving three years in the Navy. Before the war, Capt. Brown headed up general lighting activities for G. E. lamp department's engineering division. He has been identified with the G. E. lamp department at Nela Park for 22 years. Mr. Brown is a past-president of the Illuminating Engineering Society.

R. E. WORSTELL, illuminating engineer with the company's lamp department since 1925, has rejoined G. E. after serving for more than four years with the Navy. He has assumed the duties of supervisory engineer of the department's largest sales district, Atlantic, in New York City.

PHILLIP J. PRITCHARD, responsible for many radio tube developments during 45 years service with the lamp department of the company, has retired from active service. P. J. JOHNSON, assistant to Mr. Pritchard in many development operations, succeeds Mr. Pritchard as manager of Cuyahoga Lamp Works at Nela Park. R. H. HUMBERT and M. J. HAMNER have also been assigned to new positions in the lamp department, the former assuming administrative responsibility for sales activities of the lamp department and the latter coordinating research activities. Mr. Humbert has had administrative duties at Nela Park, Cleveland, since last January. Mr. Hamner was formerly manager of the lamp development laboratory. W. J. GEIGER has assumed management of the laboratory.

MAJ. THEODORE C. OHART, a veteran of almost five years service in Army Ordnance, has returned to Empire Sales District of the Lamp Department, at Buffalo, N. Y., as district engineer.

CARL M. LYNGE has been appointed manager of the company's Bridgeport Works. In his new capacity, Mr. Lynge succeeds W. STEWART CLARK as operating head of the Bridgeport plant. He will continue as assistant manager of manufacturing of the A & M department, located in Bridgeport. Mr. Clark who relinquishes the work manager title he has held for over a quarter of a century, will

Linemen Say IT'S GOOD...

and they should know

Bethlehem's serving tool has the look of a "gadget" and a funny one at that. Yet linemen will tell you that it's one of the handiest little devices that ever came along.

It was designed for making serves on Bethlehem strand by the dead-end coil method. This type of serve consists of a neat, strong wrapping of 11-gage bethanized wire around the dead end. Extensive tests have proved that the serve holds beyond the useful strength of the strand.

Even a novice can learn the technique in a few minutes' time. The lineman simply hooks one end of the wire to the strand, as shown, and engages it between the two fingers of the tool. A simple rotary motion does the rest. It takes about the same length of time as attaching conventional clips, but is less expensive. A 10-foot coil of bethanized dead-end wire costs only a few pennies.

We strongly recommend that you equip your linemen with these tools, which are intended primarily for use with Bethlehem strand. That makes a winning combination, for Bethlehem strand is flexible, uniform . . . always easy to handle . . . and armored against corrosion by a bethanized zinc coating of high purity. This coating is so ductile that it is not displaced to any harmful extent by the action of the serving tool.

Write Bethlehem Steel Co., Bethlehem, Pa., for further details. We'll gladly supply them.

★ BETHLEHEM STEEL ★

TAKE YOUR HANDS OUT OF OLD-STYLE STRAIT-JACKET *GLOVES*

Surety GIVES YOU "FINGER *FREEDOM*"

In both curved and straight-finger types, Surety Turn-Cuff Linemen's Gloves let you work limber. Pick up tools, handle wires and cables with full flexibility even when you wear leather protectors. Surety Turn-Cuff is the patented "petticoat-insulator" design that minimizes surface creepage in adverse weather, gives two added inches of protection when cuffs are worn turned down in normal conditions.

Linemen everywhere favor Surety Turn-Cuffs for comfort and assured safety. Turn-Cuffs are individually tested to guarantee that they exceed safety standards. Specify Turn-Cuffs!

THE *Surety* RUBBER CO.
CARROLLTON, OHIO

continue as A & M manufacturing manager with responsibility for the general manufacturing administration of all the department's plants.

•

Rising Made Sales Manager of Kennecott Wire & Cable

Announcement has been made of the appointment of E. S. Rising to the position of general sales manager of the Kennecott Wire & Cable Co., Phillipsdale, R. I., to succeed Edgar H. Hammond, retired.

Mr. Rising started with the U. T. Hungerford Brass & Copper Co. in the New York office in 1925 and when that company was purchased by Chase Brass & Copper Co. in 1927 he remained with the latter organization in a sales capacity. Early in 1943 Mr. Rising joined the Kennecott Wire staff in the capacity of assistant general sales manager, the position he occupied until his recent promotion.

▶ M. O. BEST, prominent Phoenix business and civic leader, has been elected chairman of the board of the recently reorganized Central Arizona Light & Power Co. The utility, which was reorganized in a move toward localized control by Arizona stockholders, serves the area of Phoenix and Salt River Valley. For a number of years, Mr. Best has been actively engaged in agricultural pursuits in the valley.

▶ WALTER GARLICK, JR., has been appointed vice-president of the American Transformer Co., Newark, N. J., to be in charge of sales and related activities. A. A. EMLEN has been made vice-president to be in charge of engineering and related activities and W. R. SMITH, Works Manager, has relieved Mr. Emlen of all supervision and responsibility in connection with factory operations.

▶ W. J. MANN, JR., formerly vice-president, is the new president of the Wolfe & Mann Mfg. Co., Baltimore, Md. Mr. Mann succeeds the late E. L. Wolfe. H. T. FEE, formerly treasurer of the company, has been made vice-president and L. J. HENNESSY, plant superintendent, has been named treasurer. In the new executive set-up, S. K. BODINE retains his position as secretary.

▶ DR. ROBERT L. TICHENOR has been appointed section head of a new fundamental research program for Thomas A. Edison, Inc. He formerly was chief of a section engaged in research on uranium at Tennessee-Eastman Corp., at Oak Ridge, Tenn.

McCone Succeeds Moore As Joshua Hendy Head

John A. McCone is the new president of the Joshua Hendy Iron Works at Sunnyvale, Calif. Charles E. Moore, former president, retired in December.

Simultaneously, it has been announced that Mr. McCone, S. D. Bechtel, K. K. Bechtel, Felix Kahn, and other associates who, together with Moore, acquired the Hendy Iron Works in 1940, have now purchased Moore's interests in the company.

Mr. McCone, who has been associated for many years with heavy industrial goods manufacturing, has currently been the executive vice-president and general manager of Consolidated Steel Corp. and a senior partner and participant in various businesses with S. D. Bechtel, including Bechtel-McCone-Parsons Co., San Francisco, and the California Shipbuilding Association.

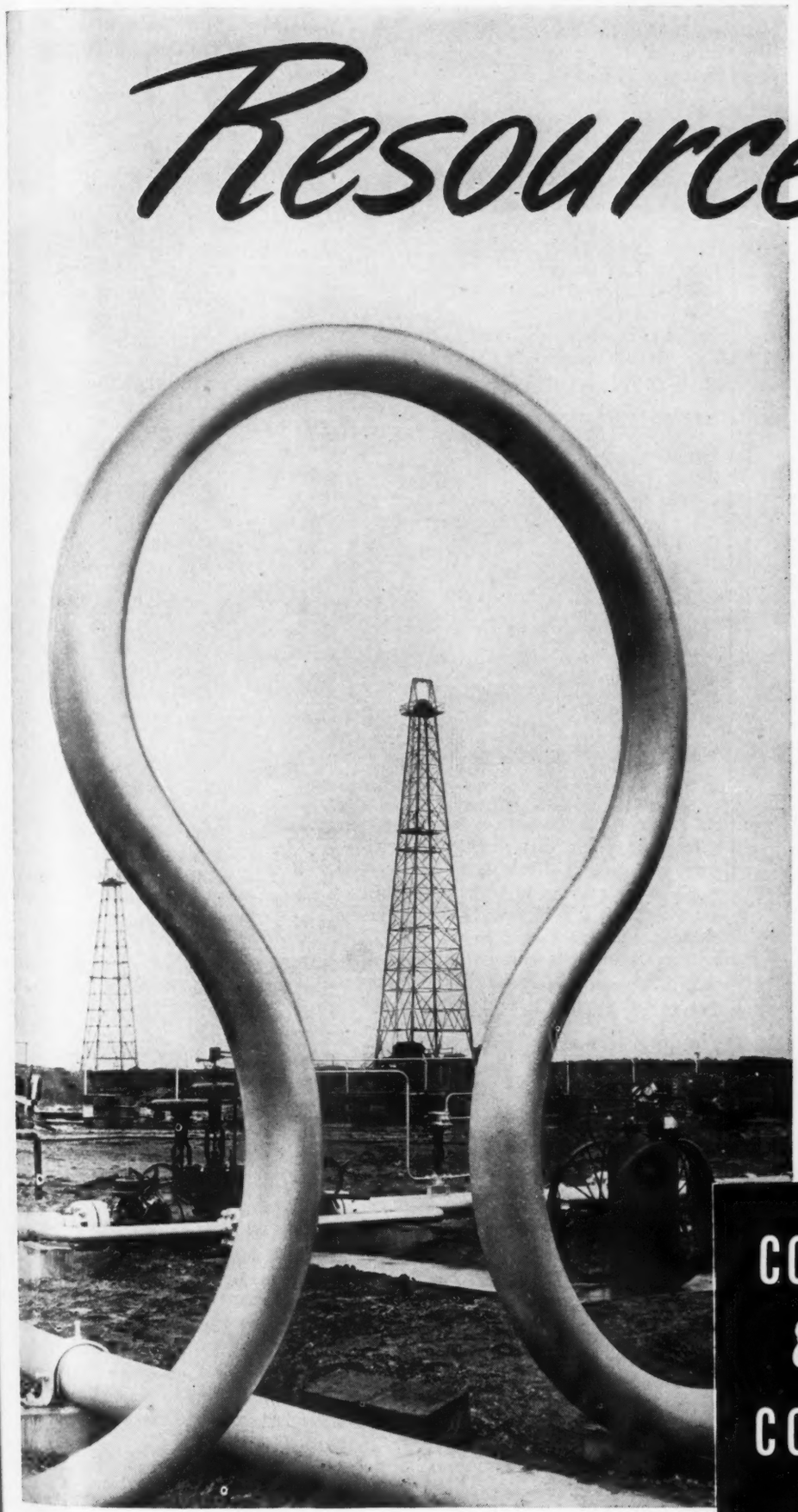
Mr. Moore retired in order to devote more time to his other machinery and building interests in the Bay area. He is president of the Moore Machinery Co. of San Francisco.

•

▶ MELTON P. JOHNS has been appointed manager of the Graybar Electric Co.'s St. Louis lamp and lighting division to succeed WILLIAM GOERISCH, who has been transferred to the New York general office.

▶ DR. ERIC T. B. GROSS has been appointed professor of electric power system engineering at Illinois Institute of Technology. Formerly an assistant professor of electrical engineering at Cornell University, Professor Gross will devote himself largely to work with Illinois Tech's $90,000 a.c. network calculator. A native of Vienna, Austria, Dr. Gross attended the University of Vienna and the Institute of Technology in Vienna. Prior to joining the staff of Illinois Institute of Technology, he was identified with the Institute of Technology in Vienna, Cornell University and the College of the City of New York. Three years ago he returned to Cornell, where he has been assistant professor of electrical engineering. His widespread experience as a practicing engineer included work as assistant electrical engineer, "Elin" Electric & Manufacturing Co., Vienna, and with the central station department of "A.E.G. Union" Electric & Manufacturing Co., Vienna, an affiliate of General Electric in various engineering capacities. He has also had broad experience as a consulting engineer, serving from 1942 through 1944 as a consultant to the United States Department of War. Dr. Gross is the author of 32 technical publications and has to his credit 14 patents in this

Resources...



Typical scene in Southwest gas and oil fields—well rigs with pipeline expansion loop in foreground.

THE GAS-BORN flame of the kitchen range is an every-day phenomenon.

Behind it lie the resources of a phenomenal industry.

They are the vast, earth-held reserves of natural gas . . . the thousands of miles of pipelines that carry it to hundreds of thousands of homes and industries . . .

They are operational efficiency . . . sound fiscal policy . . . management's integrity.

These are the essential resources that enable the Columbia System to pledge public service for years to come to 1600 communities in an area supporting more than 5,000,000 people.

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Sign frame pivoted on each side allowing movement with varying wind pressures and full vision at all times.

Attractively and rigidly constructed folds compactly for storing.

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country and abroad. He is active in the American Institute of Electrical Engineers and the International Conference on Large High Voltage Power Systems.

OBITUARY

Frank F. Fowle

Frank F. Fowle, consulting electrical engineer and at one time joint editor of ELECTRICAL WORLD, whose death was announced in the January 26 issue of ELECTRICAL WORLD, page 17, was a native of San Francisco, but moving East, he received his engineering education at M.I.T.

He gained his first practical experience in the field of telephone engineering, serving nine years with the American Telephone & Telegraph Co. in various engineering capacities. From 1908-1912 he engaged in consulting engineering with offices in Chicago and frequently was called as an expert in utility rate cases.

With the retirement of W. D. Weaver, editor of ELECTRICAL WORLD, in 1912, Mr. Fowle and Dr. A. S. McAllister, formerly assistant professor of electrical engineering at Cornell University, became joint editors. In 1913 Mr. Fowle became editor-in-chief of the "Standard Handbook for Electrical Engineers" and entered engineering practice again in New York. He served as receiver of the Central Union Telephone Co. from 1914 to 1919 and since 1920 he had been head of Frank F. Fowle & Co., Chicago.

Mr. Fowle was a member of the American Institute of Electrical Engineers and had also been active in the Illuminating Engineering Society and the Western Society of Engineers. Last year he and Robert L. Anderson of Winnetka, Ill., received the Octave Chanute Medal for 1944 from the Western Society of Engineers, awarded each year for the best papers on electrical, mechanical or civil engineering subjects presented before the society.

▶ CHARLES A. MCCULLOCH, corporation executive and at one time receiver for the former Middle West Utilities Co., Insull holding company, died on January 24 at Miami Beach, Fla., at the age of 70. Born in Chicago, he began his career in the newspaper industry. In 1903 he became general manager of the Frank Parmelee Transfer Co. and later was vice-president of the Yellow Cab Manufacturing Co. He was active in the organization of the Omnibus Corporation and the establishment of a comprehensive bus service in Chicago. In 1931, Mr. McCulloch became co-receiver with the late Edward Hurley of the various Insull properties, chief of which was the Middle West Utilities Co. After the death of Mr. Hurley, Mr. McCulloch became sole receiver under the jurisdiction of the Federal Court until the company was reorganized in 1934. He resigned last year as a director of the Commonwealth Edison Co.

▶ BRYSON D. HORTON, well known electrical engineer and inventor of the enclosed electrical safety switch and other devices, died on December 14 in the University of Michigan Hospital, Detroit. He was 74 years old. In 1903 Mr. Horton founded the Square D. Company and served as its president until 1928. It was during this time that he invented the arcless enclosed fuse and Square D electrical safety switches. Mr. Horton was born in Fenton, Mich., and was graduated from the University of Michigan. He served as chief electrician of the U. S. S. Yosemite during the Spanish-American War, and until 1903 he served as chief electrical engineer for the Detroit Public Lighting Commission. Mr. Horton was a member of the board of trustees of the Rackham Engineering Foundation.

▶ WILLIAM F. NIMBLETT, who had been lines superintendent of the Monongahela Power Co., Fairmont, W. Va., since 1924, died on December 10 as the result of injuries sustained when an automobile struck him. Mr. Nimblett was one of the most important figures over a period of years in the growth of the operations department and at the time of his death was especially busy in carrying out details of a new rural line program.

▶ CYRIL H. THOMAS, one of the founders of the Royal Electric Manufacturing Co., Chicago, died on January 10 in Tucson, Ariz., where he had resided since his retirement from business in 1943.

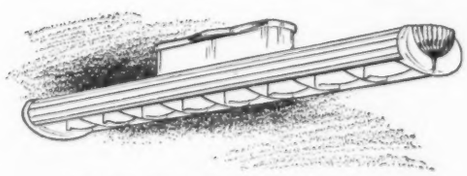
▶ E. C. BRANTLY, manager of the water, gas and electric department, Danville, Va., died recently. Mr. Brantly had recently been elected for a new two-year term by the council and assumed the term on January 1.

Virden Opens the Residential Fluorescent Market

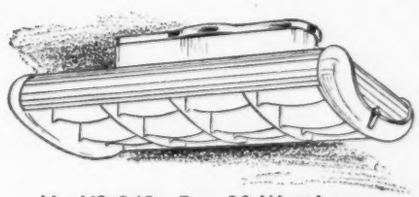
Virden's VS-224 featured above is smart—in a true sense.

It utilizes modern plastics and metals to achieve lightness, grace and beauty. That's smart—but while its designer had in mind a modestly deluxe kitchen unit, the public grasps a wider range of usefulness—that's smarter.

The public sees in these fixtures fluorescent lighting for dining room, bathroom or bedroom. They want fluorescent now. This fixture and its companion No. VS-242 make fluorescent pleasantly available at reasonable cost.



No. VS-224—Two 40-Watt Lamps



No. VS-242—Four 20-Watt Lamps

JOHN C. VIRDEN CO. • Cleveland, Ohio

MANUFACTURING MARKETS

Industry Expansion Reported by REMA

Striving to meet peace-time demands that are the greatest in its history, the mechanical refrigeration and air conditioning industry has more than doubled its capacity over any pre-war year, spokesmen of the Refrigeration Equipment Manufacturers Association have estimated.

The industry's expansion includes all its products having to do with food preservation, human comfort (air conditioning), and various industrial and commercial uses ranging from the production of equipment for "cold treating" metals to newly perfected water coolers and recently designed refrigerated display cases for groceries and delicatessens.

Notable in this activity is progress in the air conditioning field where post-war requirements are said to exceed $1,000,000,000 in volume. This estimate is based on the small percentages of homes and other buildings now air conditioned, some which are: less than one percent of homes valued at $12,000 or more with central heating units; only 3 percent of department stores; 2 percent of drug stores; 7 percent of restaurants; 2 percent of doctor's offices; 30 percent of railroad cars, and similarly small figures for many other establishments.

One of the industry's most interesting and widely publicized current developments is the growth in the manufacture of equipment used in freezing foods and the storage and transportation of frozen foods, though industry spokesmen point out that this activity represents only one segment of the post-war expansion.

A late tabulation shows that more than 200 additional companies recently have entered the frozen food equipment field. These include companies which are newly established in their entirety as well as already existing firms which have opened mechanical refrigeration divisions for the first time.

REMA officials reported the industry now is working at top speed to fill an estimated demand for home and farm frozen food units—variously estimated at anywhere from 1,000,000 to 8,000,000—and for new refrigerators with frozen food compartments. Production also is being pushed on frozen food locker plant equipment, refrigerated display cases, refrigerated transportation equipment and other products needed for food freezing, distribution and storage.

•

Noma Enters Freezer Field

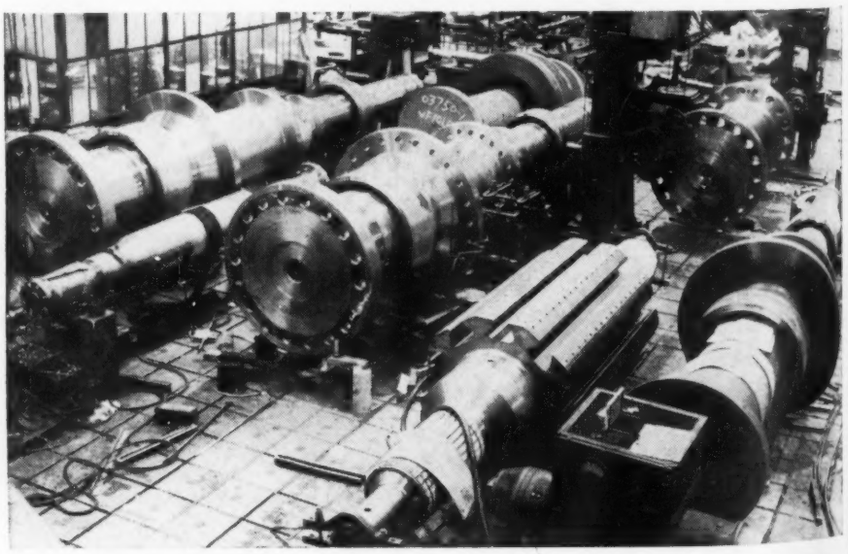
Refrigeration Corp. of America, makers of "Frigid Freeze" home and farm freezers, frozen food lockers and air-conditioning units, has been purchased by the Noma Electric Corp. The acquisition marks the second step toward completion of Noma's announced plan of expansion into the field of durable consumer goods. In December the company purchased the Estate Stove Co., Hamilton, Ohio, manufacturer of gas and electric ranges and "Heatrola" oil, gas and wood-fired space heaters. John Bess will continue as president of Refrigeration Corp. and no change in management or policy is contemplated.

Plastics Group Starts Education Program

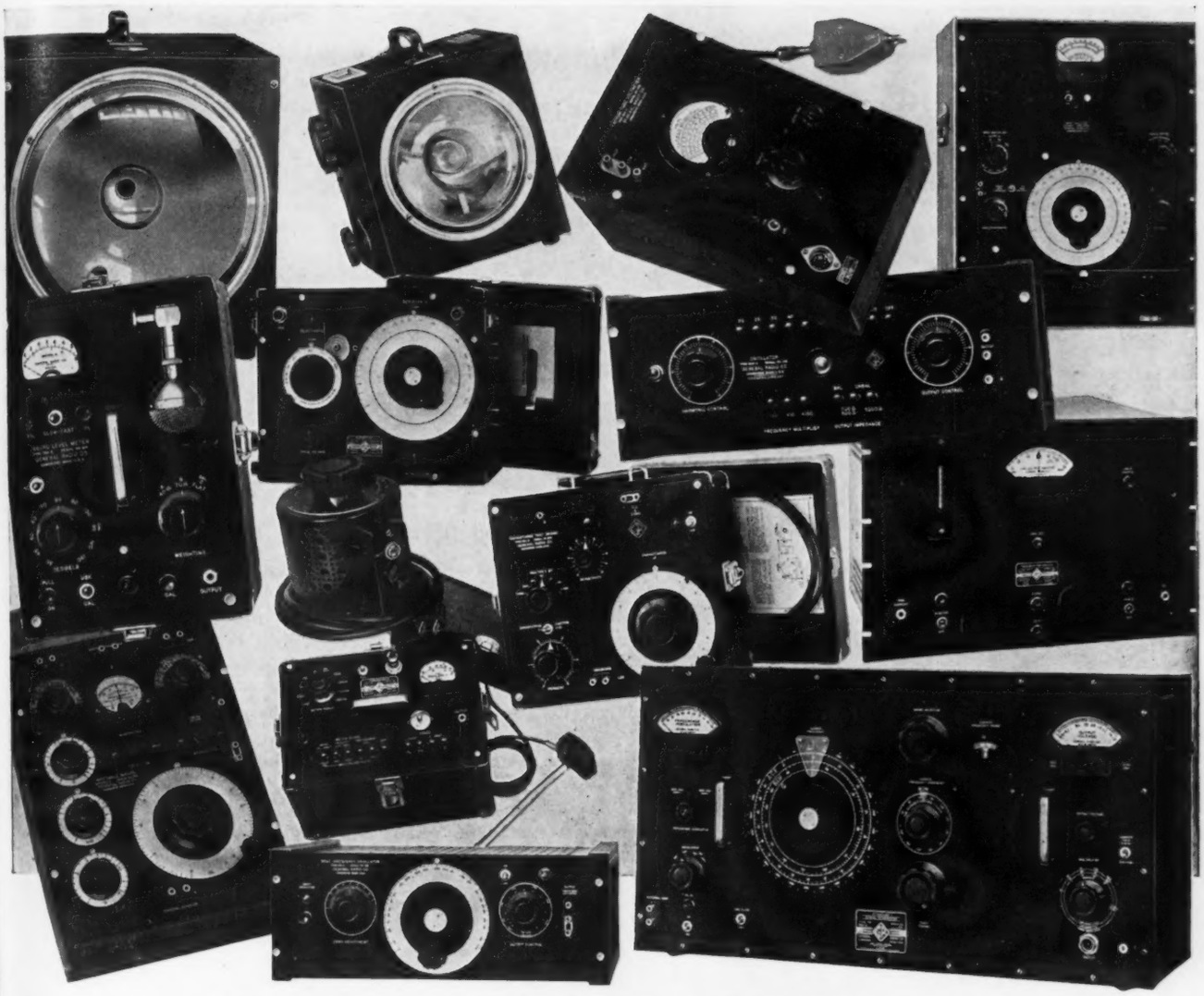
Plastic manufacturers are planning an aggressive educational program to "debunk some of the fantastic claims" made for that product by irresponsible persons in the trade, William T. Cruse, executive vice-president of the Society of the Plastics Industry, Inc., recently disclosed. In this connection, the society is preparing a booklet for the trade which will outline the various types of plastic materials and their uses. The booklet also will contain a list of more than 100 approved schools, colleges and universities which have classes in plastics, their manufacture and design.

Although there are some bottlenecks in the industry owing to lack of tool and die-makers, volume of business currently is running at approximately the wartime peak, it was stated. This is attributed to the enormous backlog of orders from civilian sources. During the war, approximately 85 percent of the plastic industry's output went to the armed forces, including such standard products as knives, forks, plates and other items produced prior to the war for civilian use. Such articles can now be produced for civilian use without any reconversion problem, according to the announcement.

Despite the present wide use of plastics and prospects for further expansion during the next year, the industry as a whole is not a producer of heavy tonnage. During 1944, about 350,000 tons of materials were produced. It is anticipated that the 1945 total will approximate that figure and that a gradual increase will follow in 1946. Current production of plastic



NO PRODUCTION—View of one section of heavy apparatus section of General Electric plant taken shortly after the electrical strike began. The shafts of several big generators await the return of workmen so that soon these units can be grinding out kilowatts



IN *ANY* LABORATORY . . .

It is difficult to picture any modern scientific or industrial laboratory that does not have need for some G-R instrument. The considerable impetus given to electronic research during the war has greatly expanded the need for G-R equipment.

Since it was founded in 1915, General Radio has developed, manufactured and supplied industry with an increasingly large number of instruments for audio-and radio-frequency measurements, until at the present time the complete line of G-R equipment and accessories is numbered in the hundreds of models.

General Radio instruments include:

INDUSTRIAL INSTRUMENTS: Stroboscopes, Sound and Vibration Meters and Analyzers, D-C Amplifiers, Variac Continuously-adjustable Transformers

WAVEFORM INSTRUMENTS: Wave Analyzer, Modulation Meter, Distortion Meter, Wave Filters, Oscilograph Recorder

FREQUENCY MEASURING EQUIPMENT: Primary and Secondary Standards of Frequency, Interpolation Equipment, Heterodyne Frequency Meters, Frequency Monitors, Wavemeters

BRIDGES for measuring: Capacitance, Power Factor, Inductance, Resistance, Vacuum-tube Characteristics

RESISTANCE: Standards, Decade Resistors, Resistance Units, Attenuators, Rheostat-potentiometers

CAPACITANCE: Air and Mica Standards, General-Purpose Fixed and Variable Condensers

INDUCTANCE: Standards and Variable Inductors

STANDARD-SIGNAL GENERATORS

OSCILLATORS: Electronic Audio- and Radio-frequency, Pulse Generator, Tuning Forks

METERS: Vacuum-tube and Rectifier-type Voltmeters, Microvolter, Megohmmeters, Oxide Rectifiers

PARTS AND ACCESSORIES: Switches, Dials and Knobs, Plugs and Jacks, R-F Chokes

Before you buy any electronic laboratory measuring equipment, it will pay you to investigate the G-R line.

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articles is approximately 500 percent over the pre-war level.

Leaders in the industry feel that the phenomenal increase witnessed during the war years will be maintained in the future, but that the pace of future expansion will be slowed down substantially.

•

Sherman Electronics Company Organized

Announcement has been made of the formation of the Sherman Industrial Electronics Co. of Belleville, N. J., which was incorporated under the laws of New Jersey. The new company is an engineering and manufacturing organization devoted to industrial electronic heating equipment.

The company's incorporators and officers have long been active in the electronic heating field. V. W. Sherman, president, was formerly manager, industrial electronics division of Federal Telephone & Radio Corp., Newark, N. J. He set up and directed that company's industrial electronics division. A. Noar, secretary of the company and N. Carver, chief engineer, were formerly associated with Mr. Sherman in the industrial electronics division where Mr. Noar was in charge of production and Mr. Carver was senior engineer.

Special electronic ovens of a new conveyor type have been developed by Sherman Industrial Electronics Co. for the food and book binding industries. By means of high frequency dielectric heating, bakery products may be uniformly through heated and "baked" in as little time as 75 seconds on a continuous production type "band" or conveyor oven. The oven is 4 ft. wide and 20 ft. long and is equipped with three electronic heaters and full automatic control.

Offices and plant are located at 503 Washington Avenue, Belleville, N. J.

•

OPA Sets Stove Ceilings

OPA has announced that 1942 price ceilings will be effective for new gas and electric cooking stoves. Both types, now becoming available, will be in two sizes, the standard range and an apartment size.

•

Will Call Preferred Stock

Allis-Chalmers Manufacturing Co. has decided to call for redemption on March 4 the remaining outstanding shares of 4 percent cumulative convertible preferred stock. Price, plus accrued dividends to March 4, will be $105 a share.

Sylvania Completes Lighting Survey

A potential market of 4,263,000 commercial establishments has been almost totally ignored by fluorescent lighting salesmen, according to Frank Mansfield, director of research for Sylvania Electric Products Inc., who revealed the findings of the company's first commercial lighting survey.

"Throughout the entire commercial field," declared Mr. Mansfield, "not more than ten or twelve percent of the lighting has been converted to fluorescent. Yet, all but five percent of the non-users think it has an advantage over incandescent lighting. Three out of every ten non-users don't know enough about fluorescent lighting to decide whether to install it or not, and 85 percent of those who have already installed this newer type lighting initiated the purchases themselves."

Conducted in cities of 2,000 population and over, from coast to coast, the survey, which is the first in a continuing series of studies on commercial establishments, was designed to help Sylvania Electric determine the market for fluorescent lamps and fixtures and to find the most popular channels of distribution. Commercial establishments surveyed in the study included retailers, wholesalers, service organizations, hotels, banks, offices, apartment and public buildings, schools, hospitals, churches, amusement places, professional offices and others.

Owners of 22 percent of the establishments surveyed expected to install fluorescent lamps and fixtures. A third said they will continue to use incandescent bulbs and 46 percent were undecided about changing to fluorescent. "The first group," Mr. Mansfield stated, "are pushovers for the lighting salesman. They don't need selling. But plenty of room remains for a good, intelligent sales job on the other two groups. From the jobber's viewpoint the big problem in getting to this market is profit engineering. Although the lamp and fixture sales potential and the power potential for utility companies is tremendous, the market is spread all over the map. . . ."

Nearly half of the people who installed fluorescent lamps and fixtures in commercial establishments did so because they expected to secure better light. Thirty-eight percent changed over because they felt fluorescent lamps would be more economical to operate, and the remainder believed they would be more up-to-date and attractive, easier on the eyes, give better spread of light, etc.

"It is interesting to note," Mr. Mansfield declared, "that only 5 percent of these people installed fluorescent lighting for the most obvious reason—to help sell their merchandise. This fact alone indicates an urgent need for real salesmanship on the part of lighting salesmen."

•

"How-To-Use-It" Judges Selected by Wiremold

The Wiremold Co., Hartford, Conn., has secured the services of four men well known in the electrical industry to act as judges of material submitted in their How-To-Use-It Contest. They are Laurence W. Davis, general manager, National Electrical Contractors Association; S. J. O'Brien, president, Electrical and Gas Association of New York; O. Fred Rost, editor and publisher, *Wholesaler's Salesman*, and Victor H. Tousley, electrical field engineer, National Fire Protection Association.

The contest, which is open to all electrical contractors and maintenance men and which closes March 31, calls for layout data, photographs, sketches, and detailed description of any Wiremold installation.

Awards will be made for those installations judged as showing business-building possibilities in a wide field, as well as good judgment in the selection and use of Wiremold products.

•

Curtis Lighting Announces Skylux Contest Winners

Two sharp guesses, both identical and both by Pennsylvanians, resulted in a tie for first place in the Skylux Guessing Contest conducted by Curtis Lighting Inc. during the Victory Lighting Jubilee in November. Paul R. Kuhn, Penn Central Equipment Co., Altoona, and Adam Tampanell, Wm. Penn Appliance Co., Philadelphia, came within 100 ft. of naming the number of miles of Skylux sold since its introduction in September, 1939. The winners thus split $300 in Victory Bonds offered as first and second prizes. Third prize of a $50 bond went to I. Parker, Birdseye Eastern Sales Co., New York, who came within a mile of the right answer.

Officials of Curtis Lighting Inc., Chicago, report that guessing was spirited if erratic. From a field of 600 entries, guesses ranged from 3 miles to 1,000,010.

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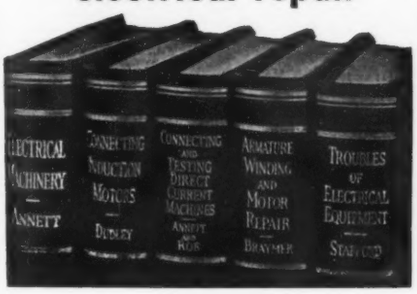
Philco Unit Changes Name

The Board of Directors of Philco Corp. has changed the name of Philco Radio & Television Corp., a wholly owned sub-

It's YOUR future—Make the most of it!

Start now to earn the bigger pay in electrical repair


Electrical Machinery — Annett
Connecting Induction Motors — Dudley
Connecting and Testing Direct Current Machines — Annett and Rios
Armature Winding and Motor Repair — Brenner
Troubles of Electrical Equipment — Stafford

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Includes trouble - shooting book

Now in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

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sidiary which handles the national distribution of Philco products in the United States, to Philco Products Incorporated.

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New Cold Room Built to Test Rubber

A new cold room in which rubber and synthetic rubber compounds and products of many types, plastics and other materials can be tested at temperatures down to minus 90 deg. F. has been installed by The B. F. Goodrich Co. at its Akron, Ohio, plants. Temperatures in the cold room can be varied from 50 deg. above to 90 deg. below F.

TECHNICIAN in electrically heated suit enters new cold room to examine specimens under test

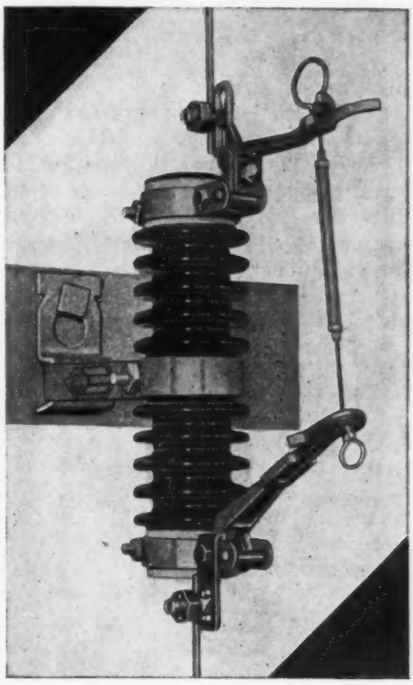
Thirty feet long, 15 feet wide, the cold room has five working units, each six feet square, cooled by a three-stage compressor unit and a single stage compressor using Freon 12 and 22 as refrigerants. Each unit operates separately, with electrically controlled temperatures charted for a 24-hour study at different levels.

The new unit is large enough to permit tests of equipment under temperatures found in the colder parts of the United Staes and Canada, as well as those encountered in high altitude flying.

Capable of taking a load of 250 lb. of rubber, synthetic rubber or plastics, 500 lb. of steel or 100 lb. of oil, each unit is equipped with a door having a non-locking catch, and an alarm operated from within the unit as further protection against locking in the operator. All operators wear electrically heated clothing. Four of the units have temperature ranges from 50 deg. above to 65 deg. below zero, while the fifth has a range from 50 deg. above to 90 deg. below.

The cold unit has 16 inches of insulation on the sides and top and 19 inches

MATTHEWS PROTECTOLINK CUTOUTS



Efficient protection at low cost is provided in these ruggedly constructed open link type cutouts. Protectolink fuse links are designed so they cannot be installed upside down and design of contact arms permits ease of fuse link installation. The spring tensioned lower arm automatically seats fuse link contacts into contact recesses in the arms, thereby assuring positive and radio noiseproof contacts. Matthews Protectolink Cutouts and Fuse Links are interchangeably adaptable with all other makes. Rated 50 amperes current carrying capacity and 5 Kv., 7.5/12.5 KV. Grd. Y and 15 KV. voltage ratings.

Write for Bulletin 101-A

W. N. MATTHEWS CORP.
3722 FOREST PARK BLVD.
ST. LOUIS 8, MO.

next to the floor. The large entry room is provided with a Niagara No-Frost unit to absorb all moisture, making it unnecessary to defrost the cold room. Moisture is distilled off outside.

First efforts to test effects of low temperatures on rubber compounds was immersion of samples in cups of alcohol cooled by dry ice. This was soon discarded, however, because temperatures could not be readily and accurately controlled, and because of the solvent effect of the alcohol on the compounds. The first refrigeration room was then created.

The new unit is thus the latest development of the company's research on testing under extreme cold, with the lessons learned over many years incorporated in its design methods.

•

Canadian Contract Signed Under New Pole Policy

What is reported to be the first contract placed in Canada under a new policy adopted in the United States with a view to meeting demands of utility companies for poles, has now been placed with the Hanson Lumber & Timber Co. of Smithers, B. C. M. H. Sperry, president, Valentine Clark Corp., St. Paul, Minn., met Olaf Hanson, president of the Hanson company in Smithers recently to draw up the contract.

Mr. Sperry, who is also a member of the OPA, and is in charge of materials for the large utility companies, explained that the demand for cedar poles cannot be met for several years to come, and for this reason they are turning to the less popular hemlock, lodgepole pine, jackpine and fir to meet the emergency. It is intended to use these species of poles for branch or feeder lines. There is an almost unlimited quantity of this timber in the Skeens and Bulkley Valleys, and a preliminary contract has been awarded the Hanson company, with a selection of carlots to be made all along this C.N.R. line from Prince Rupert to the Alberta boundary.

•

Organizes Foreign Unit

Formation of a new service department to help customers in South America and the Caribbean area with problems of equipment and operation of electrical machinery has been announced by W. E. Knox, vice-president of the Westinghouse Electric International Co. The new department will supplement present offices in the area. J. F. Mann, formerly assistant manager of the industrial apparatus department of the company in New York, was appointed manager of the new department.

Field Reports on Business

Strikes in electrical manufacturing plants and in the steel and motor vehicle industries have seriously upset production and delivery schedules. Material shortages are becoming more acute and stocks of electrical merchandise are rapidly being depleted. Retail sales continue on a high level of activity.

CHICAGO

Forty manufacturers are represented in the new Home of Tomorrow Electrical Living Exposition just opened downtown by Commonwealth Edison Co., featuring 12 full-size model rooms equipped with the latest lighting and appliances, from stokers to frozen food lockers.

A survey of 12,000 appliance dealers in the area shows most think home freezers will not sell until food firms establish home delivery routes, and then only 25 percent of homes will buy freezers. Also revealed was that 50 percent of dealers plan displaying electric refrigerators as part of complete electric kitchens rather than individually, a move termed the most important single new development in refrigeration merchandising technique. On the other hand, a more optimistic indication of the future of freezing is that the $5,600,000 plant formerly owned by Republic Aviation at Evansville, Ind., is being converted by International Harvester to manufacture of refrigeration units including home and farm freezers, two-temperature household refrigerators and special farm milk coolers.

Before the steel strike, production of refrigerators, washing machines and vacuum cleaners was already two months behind the reconversion schedule, due chiefly to shortage of special steel for chrome plating. A new firm—Morton Appliance Co.—has entered the appliance manufacturing field in Chicago with electric ironers and washers, spearheading a complete line.

Construction of all home units (including apartment units) in this area in 1945 climbed back to the 1940 level of $60 000.000, with the value of apartment units built rising from less than $1.000.000 in 1940 to $11,000,000 for 1945. The $60,000.000 for the year was $32,000,000 less than 1941, but $27,000,000 more than 1944.

NEW ENGLAND

Strikes in electrical manufacturing plants and in the steel and motor vehicle industries have seriously upset production and delivery schedules in the northeast. Material shortages are becoming more acute for this reason, and stocks of electrical merchandise are rapidly being depleted from previous low levels. A survey of the distribution line construction situation in this territory indicates that in general it has not yet become necessary to stop such work for lack of materials, although some curtailment has begun in order to conserve existing subnormal inventories of poles, crossarms and insulators to meet any emergency demands resulting from sleet storms or other severe weather conditions. Protracted strikes would threaten cessation of line construction in many areas.

Electric Institute of Boston, Inc., completing its first year, reports encouraging progress in industry unification to promote electric service and sales in all branches, and announces active programs for 1946 in many fields, notably adequate wiring, lighting, industrial improvements, and appliances. A sales training program is also scheduled. Poles are very scarce in the market, but wire is in somewhat better supply and despite extreme winter weather, electric air heaters of the portable type were sporadically on display for sale at the beginning of this week.

Narragansett Electric Co., Providence, R. I., plans to expend about $500,000 this year in improving its distribution system, including installation of aerial cable, underground circuits and a new substation in the East Side area. Municipal street lighting surveys are increasing in number. Steady progress is being made in the installation of network transformer vaults in downtown Boston by Boston Edison Co.

NEW YORK

Many corporate expansion programs may have to be revised or postponed if the current strike situation is not promptly relieved, a report of the survey committee of the National Association of Purchasing Agents has disclosed. The survey stated that reports from all sections indicate post-war plans for production have been temporarily stymied. "The recent optimistic picture of rapid reconversion with maximum production and employment must be completely revised, at least until this labor situation is cleared up satisfactorily and confidence is restored."

Civil engineering construction volume in continental United States totalled $101,433,000 for the week ended January 24, 1946, as reported to *Engineering News-Record*. This volume was the highest reported since the week of June 3, 1943. The week's total was 124 percent greater than the preceding week and 1,054 percent greater than the corresponding week of 1945.

Retail trade in the metropolitan area was very active last week, dollar volume showing no reduction from the high levels of recent weeks. Estimates indicated department store sales were approximately 30 percent above a year ago.

PACIFIC COAST

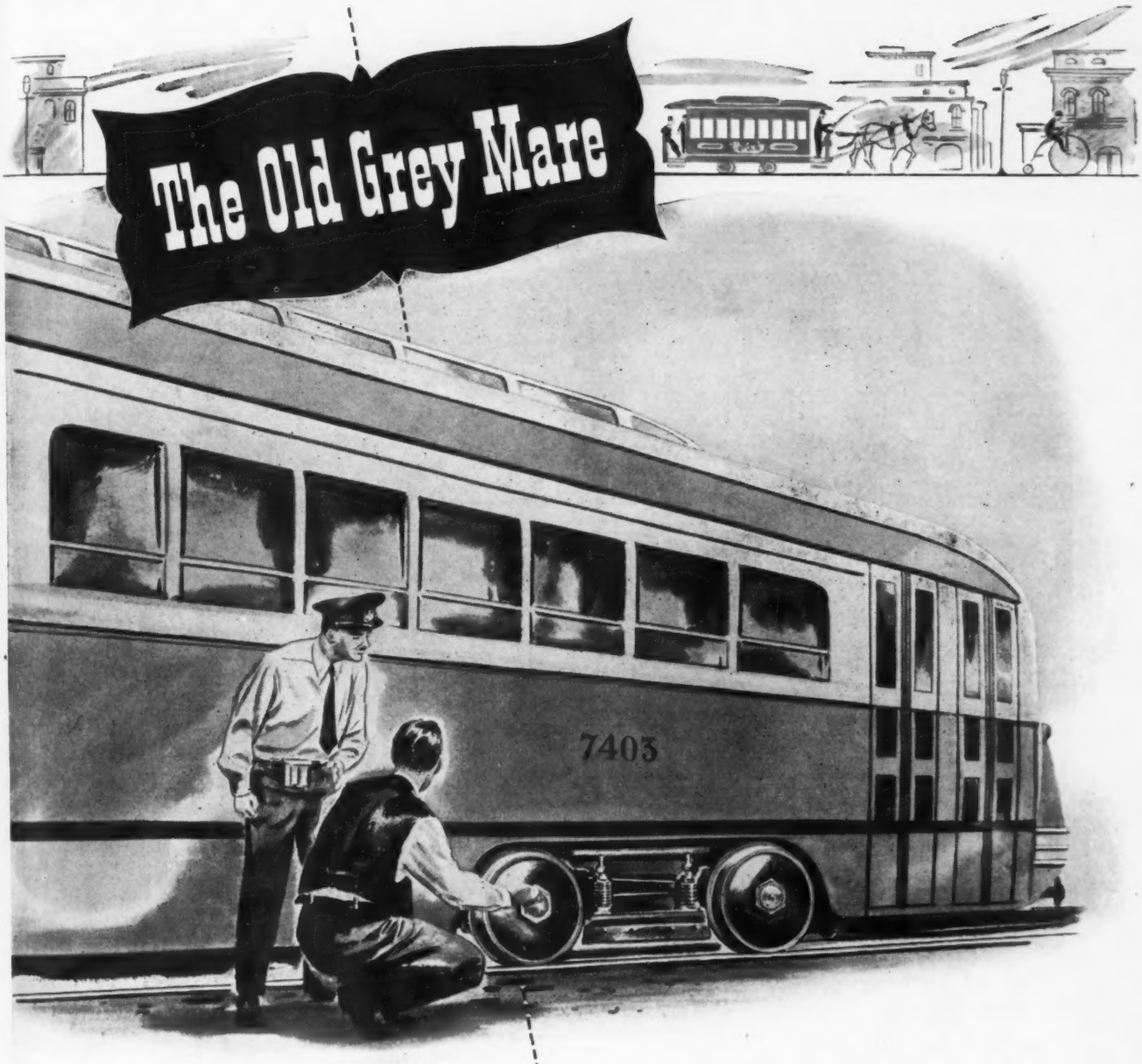
Total value of December building permits for the seven western states was $65,775,000 or nearly six times the December 1944 total, with the Los Angeles total alone exceeding that for all the western states for December a year ago. The increase was almost proportionately distributed among the states. The year's total of $389,000,000 for this region was 90 percent over that of 1944 or 1943.

New housing includes $1,500,000 subdivisions in Atherton and Hillsborough areas of San Francisco peninsula; and $825,000 for structures in Venice, Los Angeles County.

Los Angeles municipal power system has placed contract for additions to Wilmington steam plant. Idaho Power Co. has awarded a $3,000,000 contract for construction of its 16,500 kw. Hangerman Valley power station and 120 miles of transmission lines thence to Emmett and Boise. Grand Coulee is to purchase radio telephone apparatus, and Key Route interurban system of East Bay is installing a central transmitter and installing service trucks and buses with communication equipment.

The low electrical sub-bid for Beechnut's packing plant in San Jose was $102,651.

The Old Grey Mare



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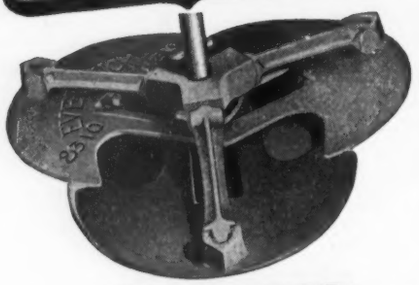

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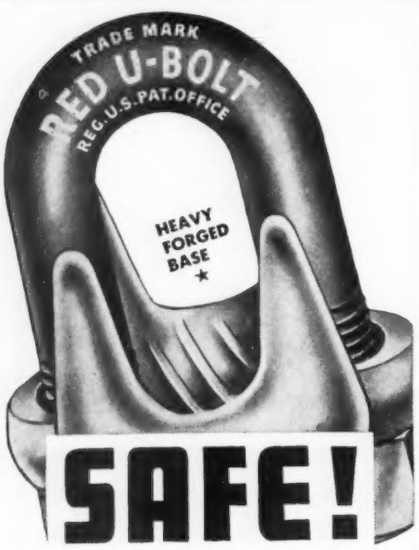

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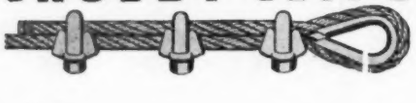

Sales Opportunities

MINNESOTA—Otter Tail Power Co., Fergus Falls, has plans in progress for expansion in steam-electric division of generating station at Hoot Lake, and proposes to begin work next summer, with completion in early part of 1947. Installation will include a 7,500-kw. turbine-generator with accessories, boiler and auxiliary equipment. Cost estimated close to $1,000,000. Line extensions will be made in Fergus Falls area. J. F. Pritchard & Co., Fidelity Bldg., Kansas City, Mo., are engineers and will be in charge of construction.

OHIO—Gruen Watch Co., Time Hill, Cincinnati, plans expansion in plant, including large new building with precision machinery and electrical equipment for extensive increased capacity. An air-conditioning system will be installed. Proposed to begin work soon. Cost estimated close to $1,000,000.

IOWA—Town Council, Sibley, plans early call for bids for new cooling tower and coal-handling equipment for municipal steam-electric power plant, where expansion will be carried out. Ralph D. Thomas & Associates, Inc., 1200 Second Ave. South, Minneapolis, Minn., is consulting engineer.

CALIFORNIA—Rainier Brewing Co., 1550 Bryant St., San Francisco, plans expansion in plant, including several new buildings, with machinery and electrical equipment for large increased production. Cost estimated about $1,000,000. Bids are scheduled to be asked at early date. Kaj Theill, 580 Market St., San Francisco, is consulting engineer.

WASHINGTON—Public Utility District No. 1, Klickitat County, White Salmon, plans call for bids in February for proposed extensions in primary and secondary lines, totaling about 320 miles, in all. Requirements will include over 40,000 lb. of Copperweld or aluminum conductor, 4,600 wood poles, 30 to 40 ft. high, transformers and miscellaneous equipment. Cost estimated about $450,000. J. W. Carey & Associates, Alaska Trade Bldg., Seattle, are consulting engineers.

INDIANA—American Home Foods, Inc., Dr. Clapp Baby Foods Division, 105 West Monroe St., Chicago, Ill., has approved plans for new one-story plant, 272 by 560 ft., at Elkhart, with machinery and electrical equipment for large capacity. A power house will be built. Cost reported over $850,000. Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J., is engineer and will supervise building erection.

OREGON—Northwestern Electric Co., Portland, plans new 110,000-volt transmission line from local Albina power substation to connection with Bonneville high-tension system at Troutdale, about 15 miles, estimated to cost approximately $500,000. Also will make extensions in distribution lines in different parts of territory, to cost about $665,000, including power substations and other operating facilities. Both projects are part of 1946 line expansion program of company.

MINNESOTA—Water and Light Commission, Virginia, will receive bids until February 11 for construction of addition to municipal power station for expansion in steam division, including reinforced-concrete stack. Also, until February 25, for two watertube steam boilers, each with rating of 40,000 lb. steam per hour, with two underfeed stokers, fans, duct work and complete auxiliary equipment; coal bunkers with capacity of 166 tons; and extension and reinstallation of present coal conveyor, all as per plans and specifications on file.

NEW MEXICO—Bureau of Reclamation, Denver, Colo., will receive bids until February 15 for three 500-kva., single-phase, 60-cycle, oil-immersed, self-cooled outdoor-type transformers for installation in power substation at White Sands, Rio Grande project, New Mexico-Texas. Equipment will be installed by government (Specifications 1153).

MASSACHUSETTS—Ludlow Mfg. & Sales Co., Ludlow, has plans for new power house at local textile mill. No estimate of cost announced. Work will begin soon.

INDIANA—Indianapolis Power & Light Co., Indianapolis, will soon begin work on superstructure for proposed addition to Perry power plant, Kentucky Ave., for expansion in steam division, to be 102 by 190 ft., and 60 ft. high. Installation will include new high-pressure boilers and auxiliary equipment, with entire project estimated to cost approximately $1,000,000. Gibbs & Hill, Inc., 331 Madison Ave., New York, N. Y., is consulting engineer.

COLORADO—Bureau of Reclamation, Denver, will receive bids until February 11 for nine rotary-type pumps and electric motors, coupled and mounted as a unit, each with rating of 35 gal. of oil per min. at 1,000 lb. per sq. in. discharge pressure; not including motor starters, but otherwise complete (Invitation F-38, 414-A-3).

SOUTH CAROLINA—Celanese Corp. of America, Inc., 180 Madison Ave., New York, N. Y., will have plans prepared soon for new yarn mill in vicinity of Rock Hill, where large tract of land recently was acquired. It will comprise several one and multi-story buildings, with machinery and electrical equipment for large output. A power substation will be built, as well as steam power plant, pumping station and other utility structures. Cost reported close to $10,000,000.

CALIFORNIA—Bureau of Reclamation, Denver, Colo., will receive bids until February 25 for four motor-driven gate hoists for operating 50 by 50-ft. regulating gates to be installed in spillway at Keswick dam, Kennett Division, Central Valley project. Equipment will be installed by government (Specifications 1156).

NEBRASKA—Central Nebraska Public Power & Irrigation District, Hastings, plans new transmission line from Johnson Lake to serve six or more REA districts in area east of that point, later to be extended to McCook, where connection will be made with North Platte transmission line of Platte Valley Public Power & Irrigation District. Switching station will be installed at last noted point. Entire project estimated to cost about $700,000.

NEW HAMPSHIRE—Brown Co., Berlin, plans expansion and modernization in sulphite pulp and paper mills, including number of additional buildings, with machinery and electrical equipment for considerable increased capacity. Cost reported over $2,500,000.

Recent Rate Changes

ARKANSAS-MISSOURI POWER CORP., which serves 96 towns and communities in south Missouri and north Arkansas, has announced rate reductions of approximately 30 percent for rural customers. The monthly minimum is being reduced from $2.50 to $1.75. In announcing the reduction, James Hill, Jr., president, stated that the company will construct about twice as much rural line for the new minimum as it did under the old one. The company is also reducing its rural rate for energy in excess of 200-kw.-hr. to 2½ cents per kilowatt-hour.

VIRGINIA ELECTRIC & POWER CO. will reduce its rates to Virginia customers approximately $1,368,000 a year, beginning April 1, according to an announcement by the Virginia State Corporation Commission. The revisions will save residential consumers approximately $510,000 a year, commercial and other larger customers $790,000, municiapalities on lighting rates $36,000, and the Commonwealth, chiefly in rates to State institutions, $32,000.

GULF STATES UTILITIES CO. has filed reduced electric and gas rate schedules with the Louisiana Public Service Commission, which will result in a saving of $242,000 annually for its customers. The new schedule became effective January 1. J. B. Hodge, sales manager at Baton Rouge, stated that the cut in rates affected all towns and cities in Texas as well, which were served by the Gulf States system. He added that the company served 161 cities in Louisiana and 164 in Texas. The rates are the same throughout the system in both states. The new rate schedule, applicable to all residential users served by the company, will have a top rate of 4½ cents per kilowatt-hour, this being one cent less than the old top rate.

CENTRAL ARIZONA LIGHT & POWER CO. has filed with the Arizona Corporation Commission a proposed new schedule of rates for electricity, which, according to E. H. Coe, president, represents a saving of approximately $648,000 to consumers on the basis of last year's business. The reductions will affect practically all customers of the utility, according to Mr. Coe. In making the reductions the utility is simplifying its entire rate structure by replacing ten existing rates with two that will cover 99 percent of all customers. These are residential and the general service rates. There will be no longer a differential between Phoenix residential and outside home service tariffs. Taking the old Phoenix residential rates as an example, the present charges are $1 per month for the first 12 kw.-hr.; three cents for the next 108 kw.-hr.; 2.5 cents for the next 130 kw.-hr., and 1.6 cents for all energy consumed after that, and a straight 1.2 cents for water heating. The new blanket rate for all residential use will be 80 cents per month for the first 12 kw.-hr.; 2.5 cents for the next 188 kw.-hr.; 1.5 cents per kilowatt-hour for all energy used after that, and one cent per kilowatt-hour for water heating. This schedule, according to Mr. Coe, will average 18.2 percent below the present rate.

B. C. ELECTRIC RAILWAY CO. LTD. at Vancouver has reduced its rates 25 percent in the third phase of the domestic power rate structure. It is estimated the move will save 11,000 homes in the lower mainland area of British Columbia at least $50,000 annually. The new rate applies to that portion of the monthly home consumption between 230 kw.-hr. and 1,230 kw.-hr. It cuts the charge on that 1,000 kw.-hr. from one cent to three-quarters cent. Other charges remain the same. The new rate applies only to the lower mainland. It will be of special benefit to users of water heaters and other electrical appliances.

KENTUCKY & WEST VIRGINIA POWER CO.'s new rate schedules, calling for a $213,000 reduction, have been approved by the Kentucky Public Service Commission. Commission Secretary P. H. Hyden stated the utility had offered the reduction in response to the commission's order of last December for utilities to show cause why they should not reduce their rates in view of discontinuance of the federal excess profits tax.

LAMAR, COLO., municipal electric plant customers received a rate reduction, effective January 1, which will cut the average domestic monthly bill about 8 percent and the minimum service charge to $1.00 from $1.25.

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Recent Legislation

Among bills that have been introduced in state legislatures, affecting public utilities are the following:

NEW YORK—A bill to abolish the New York State Power Authority has been introduced in the Assembly. Other bills introduced in the Assembly at Albany are: Assembly Int. No. 375 amends section 2, Public Service Law—defines gas and electric sub-metering corporations, provides for regulating thereof by public service commission and requires that other business of operator be kept separate. Referred to Public Service Committee. Assembly Int. No. 394 amends the Public Service Law, relative to keeping of accounts by utility corporations. Referred to Public Service Committee. Int. No. 402 amends section 65 Public Service Law to provide public service commission may require gas and electric corporations filing optional rate schedules to give written notice to consumers once in each calendar year, of lowest rate or form of rate available for future service to consumer, based on use in preceding 12 months. Referred to Public Service Committee. Int. No. 403 amends section 2 and adds new section 77-a-f to the Public Service Law—defines gas and electric sub-metering corporations, provides for regulation thereof by public service commission and requires that other business operator be kept separate. Referred to Public Service Committee. A bill introduced in Assembly by Assemblyman John Smolenski adds a new section 116 to the Public Service Law, which would authorize the public service commission to prescribe uniform methods of measuring and accounting for depreciation of property to be observed by public utility companies and municipalities under its jurisdiction and to fix rates of depreciation and amounts necessary for depreciation reserve. Referred to the Public Service Committee.

TEXAS—Validity of an act passed by the 49th General Assembly, exempting the sale of utility equipment in cities of less than 3,000 population from the state chain store tax, will be tested in the State Supreme Court, that body having decided to consider the state's contention that the act is "discriminatory."

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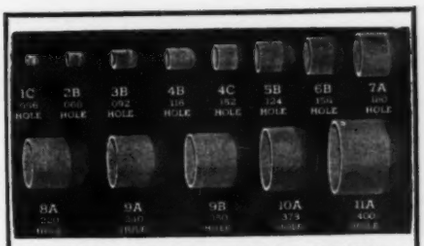
P.P.D. Will Spend $3,000,000

Consumers Public Power District, Lincoln, Neb., will spend $3,000,000 during 1946 on a 5-year expansion program.



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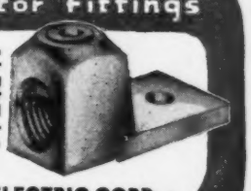

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